1984 FAA R&D AUTHORIZATION

HEARING

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION,
AVIATION, AND MATERIALS

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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1984 FAA R&D AUTHORIZATION

TUESDAY, MARCH 22, 1983

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION,
AVIATION, AND MATERIALS
Washington, D.C.

The subcommittee met, pursuant to notice, at 2:06 p.m., in room 2325, Rayburn House Office Building, Hon. Dan Glickman (acting chairman of the subcommittee) presiding.

Present: Representatives Glickman, Dymally, Harkin, Carney, Boehlert, and McCandless.

Mr. GLICKMAN. Why don't we go ahead and start? Mr. Carney is on his way, and other members should be here. As I told Mr. Helms, we may be having rollcall votes, at least one, in the next 15 or 20 minutes, and we'll stop, go vote, and come back. Then we ought to be free for at least an hour or an hour and a half during the main part of your testimony.

The subcommittee today turned its attention to the oversight of the FAA, its plans for modernizing the Nation's air traffic control system, and its use of funds authorized by last year's Airport and Airway Improvement Act.

Last year at this time, the Congress and the public had just been presented with a so-called NAS plan. That document which had been requested in the House resolution initiated by this subcommittee contained a comprehensive plan for the much-needed modernization of the entire air traffic control system.

For the first time in recent memory, the FAA had produced a bold, new plan that tied together both capital equipment needs and the R&D required at the front end. I think we were all impressed by Administrator Helms' ability in conceiving this plan and the force of his logic in advocating it.

But now, a year later, after Congress has approved it and provided the funds, it is time to inquire as to the progress being made and whether any changes in the original plan must be made as a result of events over the past year.

In addition, the committee is concerned and will inquire as to whether there has been any slippages, either in personnel or in capital expenditure in terms of the original plan as presented. We will also, of course, inquire as to other FAA R&D activities, including some of the aviation safety activities that were dealt with last year in this subcommittee.

But, in any event, it is a pleasure to have Lynn Helms here today so we can hear his report. Mr. Helms, you may read or sum-

marize your report. All of your statement will appear in the record in its entirety.

STATEMENT OF J. LYNN HELMS, ADMINISTRATOR, FEDERAL AVIATION ADMINISTRATION, ACCOMPANIED BY AL ALBRECHT, ASSOCIATE ADMINISTRATOR, DEVELOPMENT AND LOGISTICS, AND NEAL BLAKE, DEPUTY ASSOCIATE ADMINISTRATOR FOR ENGINEERING

Mr. HELMS. Thank you, Mr. Chairman. I do request that the full statement be submitted for the record, and I will make a few brief introductory remarks. Then, in an effort to acquaint the chairman and other members that may come in, with your concurrence, sir, I would like to use some Vu-Graphs, to give a briefing, because I can give the committee more information in a shorter period of time by that method.

I am pleased to be here today to report to you on the FAA's proposed 1984 research and development program and accountability for what has happened in the last year. With me are Al Albrecht, on my right, the Associate Administrator for Development and Logistics, and his Deputy for Engineering on my left, Mr. Neal Blake.

As you noted, you are especially interested in how the FAA is progressing in carrying out the national aerospace system plan, for which long-term authorizations were made available last year with the help of this subcommittee.

Although I know you are very familiar with it, as I noted before, a brief outline of just some of the topics might be helpful to some of the new members, and I particularly desire to call attention to some areas which would not normally have been concerned with an integral, technical review.

I would like to touch briefly on one of those subjects. Since I have been in office, I have emphasized the need for the agency to work with user groups in resolving areas of mutual concern.

As you may know, the FAA over the past 8 years has issued a number of proposals dealing with flight and duty time limitations for flight crew members on commercial flights. Last year, we proposed revisions to simplify these longstanding regulations. That proposal was withdrawn last November because of a number of issues raised by interested parties and the widely varying comments we received—over 600.

For example, certain segments of the industry indicated that we had not fully considered the cyclic nature of their operational requirements, such as those which are particularly heavy in the summer, or the 8-day cycle for operational use of helicopters to offshore oil rigs.

Others asserted that we had not considered the potential effects of disruption of circadian rhythm or jet lag on pilots.

I use this opportunity as an example for the chairman to note that we also believe that research should go into ways of making rules, and enforcing them, and regulation. Therefore, I have determined that we will, in fact, call together a special advisory committee to consider these issues. We hope that a new NPRM would result from that. This process of regulation by negotiation is a new approach, and one which is of special interest of the President's

regulatory task force. It has been recommended by the Administrative Conference of the United States.

Moreover, as I have said before, it reflects my philosophy that the FAA doesn't have all the answers, and when we don't I have no hesitance in seeking the advice of the users of the system—the public, commercial operators, and the flight crew members.

My goal is to begin this process rather shortly in the next few weeks. Constructive research includes not only science and engineering technology, but also research on how to manage, how to regulate, how to enforce, how to respond to the needs of those who are the users, and most important of all to me, how to meet the key asset needs we have—those of our people.

And now, Mr. Chairman, if I may, I would like to switch over and use some viewgraphs for the remaining portion of it.

I'll begin, Mr. Chairman, by initially talking about the system, identifying portions of the NAS plan, and go through and select individual programs, both showing those which were behind schedule and those which were ahead of schedule.

Then, in reading the testimony of last year, I'll connect this up with how we are managing the program.

Starting out, as shown at the bottom, of course, is the aircraft taking off and the pilot. This, of course, is part of the new automated flight service station. The automated flight service station does numerous items, but as the chart shows, there are three——

Mr. GLICKMAN. Excuse me, I am not getting any of this.

Mr. HELMS. Can you hear me now?

Mr. GLICKMAN. I certainly can. Thank you very much.

Mr. HELMS. I beg your pardon.

Mr. GLICKMAN. Maybe you might just want to sit there, Lynn, in the chair, so that——

Mr. HELMS. I'll use the pointer, then.

Mr. GLICKMAN. Use the pointer.

Mr. HELMS. As the chart shows, there are three key elements that bind the whole plan together: the flight service station automation, which is directly in response to the user public and primarily general aviation, the so-called center, and you'll see later that we have changed that terminology for various reasons, and the Mode-S radar—with its integral data link.

Starting out at the bottom, then, the automated flight service station allows us to respond directly to the user's needs. That program is approximately 1 year late. This is due to software problems. In addition, we have elected to put more time into that program to be sure that we have sufficient time to insure that all the user needs are being met.

From the time the aircraft takes off, then, it will automatically be receiving its flight clearances from phase I of the area. We have determined that area error can be put into initial phase of the advanced automation system.

Weather advisory, the next item up, can be automatic, from the Mode-S data link or directly by voice from either the center or the flight service station.

The advanced weather observation system, AWOS, is now well underway. In my quarterly review of the program it became evident that this year when we buy the 21 AWOS systems for environ-

mental field testing that that test program would not have been completed until after production award was made. Therefore, I delayed the production award until such time as I was sure that the field test would give us the data we needed for our production specification. We will have two or three systems in Alaska, one in the desert, one in a very humid area, such as Florida, another one in West Virginia, and another one up in Minnesota. We're spreading them out these being spread out around to expose them to the extremes of the climatology environment.

We will, however, make the delay up in the first year's production buy. So, the program in total is not behind. We can make up the difference without for much difficulty.

Flight plan changes, decent, profiles and other communications can come via the Mode-S data link or directly from the control center. Again, the AWOS, the automated weather observation system, which will sense the weather once each minute, will be converted from digital format to voice, and will be available to the general aviation pilot on the VOR closest to his flight path.

Weather data from the sources will be assimilated into a weather processor at the center and will be available on a 1-second callup to any controller. The weather will be updated once a minute.

So that instead of waiting for weather that is an hour old, weather can be updated once a minute and provided in essentially real time to the pilot.

In those areas where there are say four airfields, each one would require a 1-minute update time. Therefore, you would get weather updated for each airfield, but it would take 4 minutes and the data provided to the pilot would be at most 5 minutes old.

Weather, however, is the item which has received the greatest emphasis in the national plan, both by percentage increase and the dollar growth.

Continuing around the chart, it considers both the use of VORTAC, as the primary navigation system, and the introduction of some satellite capability later on before the end of the century.

We are actively evaluating the role of satellites. As of this time, we have not been able to find a satisfactory way for the satellite to effectively fit into the ATC infrastructure.

Area continues to play a major rule, this time through flow control to insure that we do not overload a particular center. We are also able to effect the control of traffic into the terminal area when a line of thunderstorms comes through and begins to back traffic up.

I wish to emphasize it is not the plan or the intent of the FAA to introduce flow control of the type we have had since August 3, 1981. Rather, I refer to that type which was in effect before August 3, 1981, but making it more effective.

The services that are shown on the Vu-Graph continue on around until you get to the end of the enroute area, and then you are ready for the to hand off to the terminal.

The Mode-S RFP will be issued probably within the next 30 days. We are essentially on schedule. The host computer RFP went out in December the proposals are in and are being evaluated. We expect to make the award in July. We will select two for the compute off.

For the new ASR-9 radar we have the proposals in and expect to award that contract before July. This program is on schedule.

One element which is not highlighted here is the collision avoidance system. It will bring additional capabilities to the system. I'll discuss it in more detail later. I've spent more time on this one chart than any other, Mr. Chairman, in order to acquaint the members with the various segments of the NAS plan.

Bill, go to the next one, please.

This, Vu-Graph depicts a representation of the sector suite of today—the 1980 sector suite. It has positions for three controllers, or two controllers and a data specialist, and usually there is a sector supervisor standing behind them.

The next slide is only an example of an R&D model of a sector suite. It is definitely not representative of the final configuration, but it does show how increased automation will do two things: first, significantly increase the capability to give us control of air space. For example, there is an automatic projection of a profile of an aircraft descending and a profile of an aircraft ascending. The controller operator with the two aircraft widely separated, and with their flight times stored in the computer, can project them ahead to determine if there is the possibility of a conflict even before the conflict resolution or alert system has to come into effect.

There will be other changes put into it, but the significance is this is accomplished by one person, so that the controller of the future will become more of an executive agent, in viewing operations and verifying they should be done.

Next slide, please. Unfortunately, this is the typical flight service station specialist work environment of today. If you go across the United States, this is the way most of them are, reams of paper such as TTY printouts of weather, which come in once an hour.

This is not the environment which we obviously want for our work force.

Next one. This is the first step toward automating flight service stations. It exists in Atlanta now and shows the automation of data for the specialists and the CRT displays upon which the data is readily called up. We have two other automated stations—one at Leesburg and the other at Indianapolis.

These stations are not fully automated and are not representative of the final configuration which I referred to in my description of the automated flight service station. It does show, however, the significant advantages, that can be had by combining automation techniques and displays.

The automated weather observation system contains a variety of sensors: One for temperature, dewpoint, and wind—that's wind velocity and direction; a visibility meter; a cloud height indicator; and an automatic device for temperature setting readout.

As I indicated before, this information can be converted automatically from digital data into voice, be transmitted to the local VOR, and broadcast continually. Approximately every 10th time the VOR will be identified, so that now pilots flying, as an example, from Albany, N.Y., to Washington, can, as they fly along, tune in ahead and see what the weather conditions are at airports along the route.

The overall program envisions that 850 of these AWOS units will be located around the United States by the FAA. An initial survey indicates up to 800 local communities will wish to purchase their own.

This program, as I said, has been underway with three systems under test last year. Twenty-one are being bought this year, and they will be installed at various geographic locations around the country to demonstrate their operation under varying environmental conditions.

The low level wind shear alert system is basically a combination of wind vanes with propellers attached, which transmit the wind direction and velocity, by radio frequency into the tower.

These are located at various spots around an airfield, taking into consideration buildings, terrain, that sort of thing. The individual anemometers sense the wind direction and velocity and transmit them to the wind data processing unit, which is a minicomputer and a microprocessor, which compares the inputs of the individual units to detect variations and to predict the presence of wind shears.

This data is then transferred to a box in front of the controller. It lights a red light and also gives an aural warning to tell him that a wind shear condition exists. He can read these in varying increments.

For example, the controller can give a 2- to 4-knot wind shear warning, or he can go 6 to 10 knots, or he can go up to 12 to 15 knots. It is recognized that this system is not infallible, and it is certainly not the ultimate solution we are after.

We have continued our work with the Atmospheric Research Laboratory in Boulder, with NASA, with Lincoln Laboratories, the Air Force, as part of DOD, and Project JAWS, leading toward a version of the next radar using postdoppler techniques which we believe will allow us to see wind shear for the first time.

It is able to pick up the microbursts of the vertical columns which move down very rapidly. Some of the data that has come out of the JAWS test is purely phenomenal. Velocity measurements of microbursts of up to 60 knots.

These columns are not predictable, and the thing which surprised us the most was they do not have to have cloud tops of 30,000, 40,000, and 50,000 feet.

In fact, most of them occur with cloud tops in the 20,000 feet and below range. And so, while we do not have all the answers, there is no question Project JAWS has given us data which we never had before.

A version then of Nexrad using pulse doppler techniques does offer us the opportunity both for much closer scrutiny around the airport and, true identification of wind shear and the gusts.

This, of course, can be presented to the controller in the cab using a type of display that we will talk about later, which we will develop as an element of the advanced automation system. He will be able to literally tell the pilot where it is within 3 to 5 miles from the airfield.

I wish to emphasize, however, this is still definitely a development program. It is not ready for production by any stretch of the imagination.

Earlier, I made reference, briefly, to TCAS. We have had TCAS-II installed in 2 operating airline aircraft for over 900 flight hours. During that period, 26 alerts were made in which the air crew did not see the intruder aircraft, but the TCAS equipment did pick it up.

To insure that the equipment could handle higher densities, we took one of the units, installed it in our research 727, took it to the Los Angeles basin, and flew it in the highest beacon density in the world.

I must say this was one of those pleasant surprises we sometimes get, Mr. Chairman. It worked better than we had hoped. It worked so well, in fact, that we have tentatively scrubbed any plans for an ATAS or other automatic assistance system on the ground.

The data is still being reduced; but, based on all that we have, we now have two manufacturers that are ready to release production drawings for TCAS-II. Additionally, operational procedures are now fully developed, and we are ready to release TCAS-I.

I have asked the manufacturers to hold up until June or July of this year before releasing those drawings, so we are absolutely certain that all of the specifications are accurate.

In addition, over 600 pages of specifications prepared by RTCA have now been completed and signed off for TCAS. We expect contractors can go to production in July. The TCAS-II operational deployment and procedures will be developed by March of next year, so that TCAS-II can, in fact, go into service by March of next year.

Boeing is now installing the wiring throughout its new aircraft for the electronics, and there is the cavity in them for the antenna.

To show the advantage of this, it is our present plan that by summer of next year, any air carrier or other aircraft that has omega and TCAS-II, if he files at FL 350 and above, will be cleared for point to point direct flights.

Fantastic fuel savings will start to occur from this next year. The enhanced TCAS-II is coming along quite well. TCAS-I is ready for production also.

Mode-S is one of the key elements required to upgrade the ATC system. It will provide the capabilities for discretely, addressing aircraft and has an integral data link capability. Mode-S is compatible with the current ATC radar system and will eventually replace in both ground and airborne environments.

Let me explain the advantages of Mode-S discrete addressing capabilities. If I have the public address system in a football stadium, the number of people—100,000 hear the same message—that is what ATCRBS does. Mode-S, however, is like the telephone system. You dial a discrete number, and you communicate with the holder of that number.

The RFP for Mode-S should be released within the next 30 days. It will provide us with a discrete addressing capability and an optional a data link. If the user procures and installs an airborne unit he could be provided with up-to-date weather, flight plan changes, flight clearances, redirection, emergency warnings, et cetera.

This is extremely significant to us for aircraft that are departing, for example, from Los Angeles flying to New York, who may not

get an up-to-date weather picture of New York until they are halfway across the country or call.

With the Mode-S data link, and with the advanced automation system, the pilot will be able to press in the code for weather, press in the designators for the terminal area which he wants to go to, and within 2 seconds will get a printout of the weather. Again, the weather will be no more than 1 minute old.

This is the sort of thing which is part of the NAS plan. This program is on schedule.

Next one.

Mode-S has two primary areas which we have addressed. The first is surveillance, and that is the basic upgrading of the ATCRBS capability. I wish to emphasize that the ATCRBS transponders that are now in use will not have to be thrown away.

The signal format for Mode-S was selected to be compatible with the current ATCRBS so that the general aviation user will be able to keep his current transponder for years and years, say to about 1990 or 1991. In fact, one of the changes from last year in the NAS plan is that last year it appeared that Mode-S transponder format would have to be mandatory by 1992. We now do not believe that to be the case. We have eliminated it from the mandatory category unless there is a dramatic growth in the aviation population.

Mode-S virtually eliminates most beacon difficulties. It improves the azimuth accuracy. It increases traffic capacity. To reach the traffic capacity, which would require Mode-S transponder carriage to be mandatory, we would have to have an aircraft fleet size going from the present 220,000 to approximately 440,000, or with much higher concentrations in the local areas.

The projections that we now see do not go to that level. That is the reason we do not believe it will have to be mandatory.

In communications area Mode-S provides a two-way data link and supports the automation in metering and spacing. It will allow the controller, then, to set up, by digital form, a position in space that the pilot can fly to, thereby keeping the aircraft apart on their own.

It provides a voice backup in confirmation systems, and, of course, it provides a TCAS coordination link, although TCAS is independent of the ground. It provides a backup to TCAS, so now we have both the pilots in the air with the collision avoidance capability and, as a backup, the controller on the ground.

I wish to switch to several other topics of interest to the committee and I will return to the technical programs later.

In implementing the challenges of the NAS plan, there are at least three major items which we in the FAA have had to address the last year.

First is organizational. We had to have a firm commitment on the part of our line organizations all the way down to both implement and understand the NAS plan.

Second, there had to be a corporate staff involved. I am using the word "corporate" in the sense that the Catholic church has a corporate environment, that banks have, that universities do. That reflects the fact that, for functional elements at the highest level, there are equal functional elements at the succeeding levels—in our case, regional offices, and sector offices.

There then has to be a corporate staff involvement in both the planning for this and the implementation of it organizationally. Operationally, then, it must meet the performance objectives.

There is no secondary position. We know what we are after and must do so with ongoing business pressures. This is the item that has been so distinct in the discussions we have had with many people in laying out both how we manage it and how we implement it, the comparison being Apollo.

But, each time I pose one question I get the same answer when I say, "How did Sam Phillips and NASA schedule Apollo around the other missions to the Moon?" People usually say: "Well, they did by this Center and this."

I say: "No. How did they schedule it around the other missions to the Moon?"

And then they say, "Well, we tried this network——"

And I say, "No. How did they schedule it around the other missions to the Moon?" The distinction is there were no other missions to the Moon.

So, Apollo could be set out on the basis of whatever you wanted for that schedule and not have to worry about conflicts.

We have 85,000 instrument flight plans a day that we must keep safe with high integrity and value, and still install the the upgraded system. That is the major problem we have, then, and the operational aspects of insuring that our transition program is effective.

And in personnel, there will be changes in staff sizes, there will be retraining and reassignments, and relocations. Our work force will play a major role in the achievement of the objectives of the NAS plan.

We owe that to our people. We are going to have to train them in the new technologies. We do not want to lose our present work force. In labor relations, we have to be mindful that there are organizations out with contracts which require that we sit down and show them that new technology is coming. It is not us. It is coming.

Once you buy that new technology bug, you never get off of it. So, we have to be prepared to sit down and take a look at this. I will choose just one area as an example of what we have to do.

Go ahead.

In taking a look at the activities for a center design in the process, we first have to organize those functions that are allocated to that center. There has to be some type of organization to it, because the center is going to change with the new equipment.

Then, we have to have a definition of those center interfaces. The center can be not just air traffic control center. It can be anything from a center to a terminal facility or to a tower.

Then, we have to go into job and organizational modeling, because the individual element, the individual work force, is going to change. We must help train that controller, that technician, and the other people.

The organizational sizing will come from that, with staffing estimates, and then a physical layout modeling it. Where will we put the new host computer while the present 9020 continues in operation? How will we install, then, the cutover? We must cut over in 2

seconds. We will cut over in 2 seconds from the time we go from the old one to the new computer.

How are we going to do that? All of this will have to be modeled and laid out. Performance standards for our people, performance evaluation, training needs, and ail of this in transition plans laid out over a period of time.

Go ahead, Bill.

To do this, then, an operations planning methodology is being developed, and is well along to first design the task. Second, identify the functions which have to be accomplished. Third, put those in the proper sequence, so that as this plan starts to unfold, we are doing it just as it ought to be done. We are doing it in a logical fashion, and doing it so that we allocate the functions to people or systems.

Of all the items on this chart, that is the most significant. We must make the decision up front which of the tasks we will assign to a machine and which we will assign to the human.

We should get our people out of the menial tasks, the repetitive little things that can lead to boredom, and help them to make the transition to technology for training, and let us use the people skills for people decisions.

We must allocate those functions, then, among existing work groups and systems, and formulate the operations process, then, of how this new system is going to function throughout.

Finally, we must implement this with specific requirements in development, to meet those requirements, deploy them into the system and a closed loop system.

Mr. GLICKMAN. Why don't we stop for right now? We will be right back.

[Recess taken.]

Mr. CARNEY. Mr. Helms, I think it would be appropriate if we start now. They will be delayed just another minute or two, but Danny is very familiar with this, I think you know.

Mr. HELMS. This shows the operations systems comparisons which we were talking about, and I have selected these two clearly to make a point. On the right, indicative of how we have had to keep our records in the FAA, and for example, that could be the some 600 pilot licenses alone.

Over on the left—the new system. The reason I mention this is that there has been, of course, universal attention throughout the community drawn to the national aerospace system plan.

But, in June 1981, I first made out the specifications for, and we are now in the final stages of, and it should be completed by July this year, an administrative systems plan, which will parallel the national aerospace system plan. It sets up a way to automate the entire administrative process all the way through the functions required for merit pay increases, integrated logistics systems, all of the efforts throughout.

The Federal Government is woefully behind in the use of automation processes in the administrative network. This new program will lay it out, and it will show the way to do this through the year 2000.

This will allow us to update and keep better records of the training of our people which we will have to have as the system plan goes into effect.

I decided also to see if there are any other organizations or any other efforts which parallel what we are trying to do. Therefore, I asked the Bell System to give me an idea of what happened in one of their areas when they started out switching over from electromechanical or reed switching, and going to electronic controls, and doing their cutovers, which are similar to ours.

This chart represents one area of Illinois, one area of Chicago, which shows that they had approximately 60 million subscriber lines when they started in 1975. In the 15-year period up to 1990, they expect to go up to just under 100 million.

But, you notice, that they went more and more to electronic devices in switching. With this, the requirement for labor continued to go down for each 10,000 phones installed.

That same set of curves looks like a projection of our air traffic controllers. It looks like the same projection for our technicians and all of them.

We have to be able to address this and reassure our employees that they are not going to be out of work. And the next slide is one of the items that we have to use to show them where we are going and what we are going to do.

The system today is labor intensive. It is old technology. It has a mix of things. Some are new pieces of equipment and some old. It requires very frequent site visits—one or two times a week, just to see if the equipment is working, to repair it, and to do onsite repair and certification. A highly dispersed work force; spread out all across the country in groups of two to five; it is extremely difficult to effect a positive communication with, and this can cause them to feel they are not part of the total FAA.

Manual documentation, such as was shown by the girl in the previous Vu-Graph. We now try to go back and determine the exact configuration of a particular VOR; which changes have been put into effect; a static systems analysis, in which a particular system was looked at one point in time.

The skills we have and use are primarily based on vertical knowledge. We train people for teletypewriter, and then we move them on up to the next level, and on up to the next level, and the next level.

It is vertical knowledge now that is required to maintain and operate our system. Heavy emphasis on circuit tracing and repair—a hardware orientation. But, the system of tomorrow has to be different.

Whether I like it or not, it is going to be. First, the remote maintenance monitoring is a real time analysis, reading out constantly what is happening to the system. It is a dynamic program in which failures as they occur and/or trends which take them off the norm are constantly reported.

Therefore, you can do certification remote from the actual site and not have to visit the site anymore. State of the art equipment—such things that have been used in the industrial community now for at least 6 to 8 years and, in some cases, 10 to 12 years. Interface control systems, which automatically interface, report the

failure and the errors and advise the air traffic control system where one part of it is not functioning properly.

Integrated and independent systems, which again, are automated, so that aircraft flying from one part of the country can be automatically reassured by data link that the system is both monitoring them, and it is self-checking.

Consolidation of work centers—over 78 percent of the total savings can be realized by that. Oddly enough, only 25 percent will be realized by application of the automation itself. The automation allows us to consolidate, and the communications provide us with the information on what is going on.

Together with this, then an improvement in higher reliability; failure prediction; trend analysis, so that a VOR starts to tell us in advance when it is going down.

Functional redundancy, such as in our new computer, and in the changes that went into the MLS, from a single channel as originally laid out in its design in the late 1970's and up and through 1979.

But the failure rate is such that you have far great impact operationally if you go from a single channel to a redundant system. You have a magnitude improvement of savings in cost because you can lower the amount of effort you have to put into it to keep it on line.

Echelon maintenance—automated documentation to retrieve manuals spares information. The skills for our new work force is going to be horizontal knowledge—more of a diagnostician. This is what I meant earlier when I said we have to go back and show our technicians, our flight service station specialists, our controllers, and the rest that we will have to undertake the task of training them in this new environment. A massive training program, which means that we have to lay this out and show them that they are going to become more and more of systems analysts with a heavy emphasis on engineering.

That is the reason we launched our airway sciences degree program about a year ago; this year, our self-improvement program within the FAA; and now a new program which we will be getting underway shortly, directed toward additional education. It will be far more oriented toward engineering, and it will be less manpower-intensive.

In doing this, we will have to maintain quality of service. In May 1981, the first briefing was held to respond to me when I asked why is it that industry has quality control, or quality assurance, when I don't see it in Government?

We didn't have it in the ways that we looked at our work.

The first briefing on air traffic quality control system was conducted at Indianapolis in May 1981. Because of the labor problems we had after August, it had to be delayed, but it started picking up again 8 months ago, and it is now a formalized program in the air traffic-related activities.

Divided into two areas—quality assurance directed toward the internal evaluation, the technical evaluation of standards and system level certification; assurance, but quality control is making sure that we have maintenance procedures set in, equipment level certification, and the procedures for software testing to insure that we have quality control throughout the system.

Collectively, the users, as shown on the left, are the air traffic division, the aviation standards that they must create and then the operational procedures. The regulatory environment and, of course, the Department of Defense are the governmental agencies, general aviation, air carriers, airport operators, State aviation organizations—all of the users, if you will.

Their concerns are shown over on the right—and they are very valid concerns. Safety: Is it going to be equal to or better than? Confidence: Can I have increased confidence that this system is going to be there, and it is going to be available?

All of the thoughts expressed there have to be addressed in this transition plan and in the training program to insure that we do accomplish what we have in mind with the proper application of technology.

Finally, and this is our major item, is the human concern. While the users have their concerns, and we have to meet them, we also have to have human concerns for our employees.

In their mind, there is a large potential loss of jobs. We have to show them that with reeducation and with the projection of the normal retirement rate, we will end up hiring people throughout this entire time period.

So, we are going to have a combination then of hiring a highly trained personnel, training our own people, and providing specialized training to improve available skills.

There will be some employee relocation and retraining required. We must offer training to all of our people on these new equipments new to make sure that it goes along well, and at the same time offer them a career progression path.

If we do this, then our system will be such that we can have a high degree of confidence that we are going to be able to finally land back in the terminal system, which is to come back in and have the en route handoff automatically to the terminal to the Mode-S, have full control built in for the local controller at the airport, TCAS still monitoring as we come down, IFR, VFR, as a backup to the ground controller, continuing on around to the constant weather readout which he will have from the VOR. As he approaches the terminal area, the controller can give him with the Nexrad derivation or wind shear.

Finally, coming on in, then, to a landing with ASDE, or the airport service detection equipment, which will give us the traffic on the taxiway.

This is getting to be more important now, because the large airfields are such that with fog, the control tower literally can't see aircraft or vehicles at the extreme portions of the airfield. Therefore, we must have an automatic communications capability which would allow us to identify a particular aircraft as it is taxiing around the airfield.

In Los Angeles, for example, you literally have to shift frequencies from a ground controller on the north side of the airfield to the south side of the airfield. For those who might feel this just does not track, I recall very well that a map was printed in a number of magazines that showed that when Dallas-Fort Worth Airport was laid out and overlaid the island of Manhattan in New York, the airport was bigger than the island of Manhattan. The

airport was designed to be good to the end of the century, and here we are 9 years after it began operations and we're having to build two more north-south runways to handle the traffic.

JFK—the largest employer in Long Island in New York City; Hartsfeld International Airport, the largest employer in Georgia; the Los Angeles International Airport, 106,000 jobs; O'Hare Airport generates 118,000 jobs, so that during this last 3 to 5 years when we talked about business going down, there has been a growth industry. It is called airports.

Johnson City, Kans.—no scheduled air service, no scheduled carrier, two general airports that contribute over $8 million a year to the local economy. This system has to service all of those. It has to be able to meet the needs of all of them.

Finally, then, MLS, to give us the flexibility on curved approaches, being able to allow us to operate the aircraft in paths other than a straight line for weather; to be able to give us greater accuracy; more operational capabilities to assist in the complex environments.

It is transportable, therefore it has a greater opportunity to be used by the military. It can be used on a shipboard installation, and it provides us the flexibility of the future. Of course, it has been chosen by the international community as the international standard.

The MLS system is fully developed. It is now ready for production. We originally had a special wide body aircraft test scheduled—on a wide body that we were going to lease. But, I came into the Government to save money, and I can't see any reason to do that when we have another requirement which is to demonstrate and validate this capability for Department of Defense.

Therefore, I have offered a set of airborne MLS equipment to the Department of Defense, and the Air Force will install it in a DC–10 tanker, which will give us the wide body vehicle we need and will give us a far wider evaluation than we could have had by leasing a wide body.

These are the kinds of things which we have done. Finally, Mr. Chairman, in conclusion, I announced in October 1982 my plan to have a systems engineering and integration contractor aboard to help implement the NAS plan.

We will have that systems engineering and integration contractor to help us primarily in the system design, test, implementation and integration in the field, facilities layout, and throughout the entire program. The work statement should be completed this month.

This will be a competitive contract, and it will give us the technical assistance over the years ahead to help insure the plan is carried out after perhaps some of us are gone.

Mr. Chairman, that concludes my statement.

[The prepared statement of Mr. Helms follows:]

STATEMENT OF THE HONORABLE J. LYNN HELMS, FEDERAL AVIATION ADMINISTRATOR, BEFORE THE HOUSE SCIENCE AND TRANSPORTATION COMMITTEE, SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS, CONCERNING FAA'S FY 84 R&D PROGRAM. MARCH 22, 1983.

Mr. Chairman and Members of the Subcommittee:

I am pleased to be here today to report to you on the FAA's proposed 1984 research and development program. With me today are Al Albrecht, Associate Administrator for Development and Logistics, and his Deputy for Engineering, Neal Blake.

I understand you are especially interested in how the FAA is progressing in carrying out the National Airspace System (NAS) Plan, for which long-term authorizations were made available last year with the help of this Subcommittee. Although, I know that you are very familiar with the air traffic control system and the original NAS plan, Mr. Chairman, I think a brief outline of these topics might be helpful to the new members of the Subcommittee to serve as background for the more technical presentation that will follow.

The FAA is responsible for providing air traffic control services, from take-off to landing, to all aircraft flying under instrument flight rules (IFR). This involves air traffic control towers for airport operations; approach and departure control facilities for flight segments near the airports; and en route control centers for those segments of flight between terminal areas. Aircraft flying under visual flight rules

(VFR) often involve FAA tower operations as well. In addition, our flight service stations brief pilots on weather, assist them in filing flight plans, and provide other assistance to aircraft in flight.

To meet these responsibilities, the FAA currently operates 429 towers, 25 en route control centers, 180 automated terminal facilities, 318 flight service stations, and thousands of navigation aids and communication facilities, for a total of 20,000 facilities. In 1982, these facilities handled 50.6 million aircraft operations at towers, 27.8 million aircraft at en route centers, and 62.4 million flight services.

The U.S. air traffic control and air navigation system is the safest in the world. However, the current facilities the FAA uses to provide these services are becoming outmoded. They consist largely of vacuum tube equipment which is costly to operate and maintain. Computer capacity is gradually being reached. The large number of facilities means large overhead costs. Facilities have a variety of different computer software and controller consoles to display information. In short, the current system is labor-intensive, expensive to operate and maintain, has little capacity to accommodate future growth, and no capability to accommodate future automation needs.

Therefore, when I took office, I undertook an exhaustive review of the entire National Airspace System. Part of that effort, the National Airspace Review (NAR)--a study of the operational use of the nation's airspace, including air traffic control procedures, flight regulations, and airspace environment--is still underway, in partnership with user groups. The final NAR meeting has been moved up to November of 1984, and we expect a completed report in 1985.

Another important element of this effort is the airport plan, known as the National Plan of Integrated Airport Systems. It will be issued next year, and will identify the type and estimated cost of airport development considered necessary to provide a safe and efficient system of public-use airports in the U.S. Essentially, it will spell out for the airports the improvements that will be needed to keep their development in balance with the development and improvement of the rest of the aviation system.

The portion of the review dealing with upgrading and modernizing the ATC system was completed in 10 months and published in January of 1982 as the National Airspace System (NAS) Plan. It outlined a comprehensive plan to modernize our nation's airways--to build a safer and more efficient system.

This was a total system approach. The policy emphasis was to maximize automation--in order to increase productivity and

capacity, and to improve vital safety services, such as collision avoidance, landing systems, and weather information gathering and dissemination.

One key to the NAS plan is replacement of the present IBM 9020 computers in the centers. We have designed a phased-in approach to ensure that there will be no disruption of service in the transition to the new computers. We must have 100% success when we switch over. Therefore, the first phase will be the introduction of new "host" computers which will operate with virtually the same software currently used. This stage alone will increase capacity and improve reliability. Once we are satisfied with the new hardware, we will then introduce advanced software and new "sector suites," the consoles and displays which present information to the controllers. This will further improve reliability, and also will permit the introduction of advanced automation which will improve productivity and safety. We intend to use the same hardware, software and sector suites for our towers as well as our en route centers, thus gaining economies in development, procurement, maintenance, and training.

The higher levels of automation, known as the Automated En Route Traffic Control (AERA) concept, will reside in the same hardware and will include capabilities such as fuel efficient en route planning, flow planning and traffic management, strategic clearance planning, and full tactical clearance generation and execution--which will generate significant fuel

savings, reduce the size of the controller workforce, and reduce the incidence of system errors.

Other system improvements which have been incorporated into the NAS plan include:

Flight Service Station (FSS) automation and consolidation - which will reduce costs, provide more rapid retrieval of information by flight service specialists, and allow direct pilot access to automated weather information, flight plan filing, and ATC system status. This program was approved by the Congress in 1980, and funded by appropriations in 1981, 1982, and 1983.

Upgrading FAA's Weather Program - to provide better and more timely weather data to controllers and pilots. This program involves many elements, including:

Next Generation Radar (NEXRAD) - the joint development (with the Departments of Commerce and Defense) of a new Doppler weather radar system, which will provide us with improved hazardous weather information.

The Automated Weather Observing System (AWOS) which will make surface weather observations at locations that do not have observers and automatically transmit them into the weather communications network and to pilots. It will

include sensors for wind speed and direction, altimeter, temperature, dewpoint, ceiling, visibility, and, possibly, freezing precipitation.

The Center Weather Processor (CWP) which will more efficiently distribute and display real-time weather information to controllers and meteorologists at our en route centers. This will improve safety and reduce the high percentage of weather-related air traffic delays.

Wind Shear Detection and Forecasting - Special programs are designed to upgrade our knowledge and handling of wind shear phenomona.

Microwave Landing System (MLS)- is a precision approach and landing navigation system which will improve safety, enhance terminal area capacity, and assist in airport noise abatement through the use of its segmented or curved approach capabilities.

MODE-S/DATALINK - is a cooperative surveillance and communication system to support ATC and provide data link services such as weather information and instructions from the automated ATC system directly to the cockpit. It employs ground-based sensors (interrogators) and airborne transponders. Ground-to-air and air-to-ground data link

communications is integral with the surveillance interrogation and replies. In Mode S, each aircraft is assigned a unique address code. Using this code, interrogations can be directed to a particular aircraft and replies unambiguously identified. Interference is minimized because a sensor limits its Mode-S interrogations to targets of interest, and proper timing of interrogations permits replies from closely spaced aircraft to be received without mutual interference.

Traffic Alert and Collision Avoidance Systems (TCAS) - This concept is based on agency and international development efforts in the areas of beacon-based collision avoidance systems and air-to-air/air-to ground discrete address communications techniques utilizing Mode-S message formats. The TCAS approach provides a range of collision avoidance equipment alternatives that can provide collision protection for the full spectrum of airspace users ranging from small general aviation aircraft to large transport aircraft. TCAS equipment operates independent of the ATC system. It provides an aircraft separation assurance back-up to normal ATC surveillance coverage, and primary separation outside ATC surveillance coverage. Development and operational demonstrations of this program have run considerably ahead of the program schedule. We now have two manufacturers ready to release production drawings.

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In sum, the NAS Plan is a comprehensive and integrated modernization of the nation's airways in a manner which will improve productivity, reduce costs, increase safety, and allow flexibility. It provided the comprehensive planning background against which the Congress had the confidence to pass the Airport and Airway Improvement Act in 1982. This legislation provides for the authorization of the resources required to carry out the FY-82 to FY-87 portions of the NAS Plan and airport programs. In accordance with the Act, FAA is preparing an update of the NAS plan showing our current plans including cost estimates as we move along with the airways modernization program. I will provide you with a copy of the update as soon as it is finalized. Specific areas in which changes have been made to the plan include the following:

We have adopted an Area Control Facility (ACF) concept, which will eventually lead to the execution of both en route and terminal air traffic control from collocated facilities utilizing common equipment. This revision eliminates the Terminal Hub Consolidation from the plan and will provide for many economies in manpower, equipment, maintenance, and supply support. ACFs will be based upon optimum operational considerations and requirements, and artificial boundaries, such as FAA regions, will not be of concern. We expect to use the existing en route facilities, augmented, as necessary, to carry out the ACF

program. Implementation will start in 1985, with the initiation of construction. Operationally, they will begin to come on board in the late 1980's, coinciding with the availability of the sector suites.

Originally, mandatory carriage of beacon transponders was proposed starting in 1986. My current assessment is that overall system considerations would be better served by:

(1) requiring that all beacon transponders manufactured after a specific date in 1986 be Mode-S compatible, and

(2) deferring until 1991 or 1992 the mandatory carriage of beacon transponders. If traffic population presently forecast does not occur, then carriage may not be mandatory.

This decision will provide for a reasonable match-up of ground and airborne capabilities without introducing any early special equippage requirements on the industry.

There have been some other changes in the plan, mainly related to refinements in schedules and quantities which will not affect the overall plan implementation. In several cases, a slippage of several months in making a contract award has

appeared more significant than it really is, because the three months crosses a fiscal year. However, it is merely a three month slip. Overall, I am pleased that we are generally maintaining the schedules and the funding profiles of the Plan.

Now, I'd like to give you a progress report on a few of the major NAS Plan items.

Advanced Automation

The Host Request for Proposal (RFP) was issued in December of 1982, and we expect to award the Design Competition contracts in July of this year. The production award is planned for April of 1985 and the first systems should be delivered in early 1986.

The RFP for the Advanced Automation systems--new software and sector suites--will be issued next month and the Design Competition contract awarded in February 1984. These schedules reflect a slippage of 3-9 months. Frankly, the problem was one of start-up times--we simply underestimated them.

MODE-S

The Mode-S RFP will be issued this month. Our planning was to award the MODE-S production contract by the end of this fiscal

year. We are still striving to meet that date, but I would not be overly surprised if we went a couple of months past that and brought the contract in around the end of the calendar year. If we do slip two or three months, we have good reason to believe we can pick that much time up during the production cycle. At any rate, the systems will start being delivered in 1987 and become operational several months after delivery. Thus, I believe this program is in good shape.

Microwave Landing Systems (MLS)

The MLS Request for Proposal will be issued once the Office of Secretary of Transportation (OST) has approved the MLS Key Decision Memorandum. We're planning for a September award and expect to accept deliveries in early 1985. I believe we are going to meet that first delivery date without too much trouble.

TCAS

This program is proceeding very well. The final design guidelines for TCAS-I were issued in September of 1982. The job now rests with industry. The minimum TCAS-II is also moving along. The Minimum Operational Performance Standards

(MOPS) are essentially complete. The 600 page document provides a comprehensive description of the system based upon a thoroughly validated surveillance design of threat detection and resolution logic. We have in hand an established independent airborne collision avoidance capability that meets the operational requirements it was designed for. This is a major accomplishment. We are now working to finalize the operational procedures to accompany the implementation of this system. We will have them completed by the end of this year. The enhanced version of TCAS-II is also proceeding on schedule. The final MOPS for it will be issued in January of 1985. I'm very confident we will have TCAS operational well ahead of my original targets of 1984 and 1985.

WEATHER PROGRAMS

Mr. Chairman, I am very pleased that I took your suggestion to select a Program manager to serve as the focal point within FAA to coordinate our weather programs. As I advised you, I appointed Neal Blake to that position, and he has made great strides in pulling the various elements of the program into an integrated, agency-wide program.

At this time our efforts on NEXRAD, AWOS, and CWP are proceeding on schedule. As you no doubt are aware, we received some very direct instructions from the last Congress concerning efforts relating to wind shear. We have reached agreement with

the National Academy of Science on some specific studies on wind shear and are proceeding with the analysis of the JAWS data upon which we hope to install additional low level wind shear equipment in a productive manner. We intend to use the New Orleans installation to evaluate that phase of the results of the JAWS tests. Our plans are to have the installation in and operating by January 1984.

TRANSITION PLANNING

A vital element in the successful implementation of the NAS Plan will be the means by which the new systems and equipment are introduced into the ATC system. Our planning must provide for an evolutionary, in-service introduction into the system. We are at this time developing transition plans to provide the guidelines on how we will carry out this phase of the plan. We anticipate the first of these transition plans will become available within the next eighteen months.

SYSTEMS CONTRACTOR/MANAGEMENT OF THE NAS PLAN

A topic of great interest to Congress, the White House Science Council, and industry is how we are going to use the expertise of industry to assist us in the systems engineering, integration and implementation of the NAS Plan. We are currently working on what I hope will be the final statement of work for such a contract. We urgently need to award this

contract and get the systems contractor on board. I'm personally hopeful we can achieve that milestone before the end of the year.

The systems contractor will carry out all of the systems engineering and integration associated with the NAS Plan projects. However, the FAA will remain in control of the overall management of the program and institutional program continuity will be provided from within FAA, primarily by its career management personnel.

In this regard, I want to point out an important organizational change I've ordered which will improve FAA's ability to manage the airway's modernization program. My experience has shown me that the key to good management is accountability. When you have a large undertaking such as the NAS plan, which has many sub-projects that must fit together, there must be one office responsible for coordination of all of these elements. In the past, FAA has been criticized because its R&D efforts did not dovetail with its Facilities and Equipment program--which implements the introduction of new technology into the field. I have combined these functions into one complex, reporting to the same Associate Administrator - Al Albrecht. Al will thus have overall responsibility for the NAS plan implementation, from R&D through field deployment of the new systems. The two new offices which will carry out the plan, the System

Engineering Service and the Program Engineering and Maintenance Service are headed by people integrally involved in the development of the NAS plan. In addition, Al has a new Deputy who brings to his office strong Airways Facilities and R&D background plus acquisition experience as the former head of FAA's Logistics Service. Thus, I feel that we have a strong management team in place to oversee the implementation of the NAS plan.

We will have in place by the end of this year the method of institutionalizing the continuity of technical appraisal, management focus, technical evaluation, and continuation of planning that will ensure the NAS Plan will be completed as envisioned.

Finally, Mr. Chairman, I know that some concerns have been raised about the FAA's forecasts for increased aviation activity. The recent forecast projects less growth for general aviation through the mid-nineties than our previous forecasts. The question arises, then, as to whether the NAS Plan is needed if aviation activity does not grow as fast as FAA predicted. My response is the same as it was in testimony before the Congress last year. While I am confident that aviation will experience tremendous growth over the next two decades, the improvements and upgrading of the ATC system covered by the NAS Plan are not derived solely from forecast growth in air traffic

activity. They are needed to replace the obsolete, labor-intensive elements of the system to facilitate its operation in a safer, more reliable, more efficient, and cost effective manner. Thus, the NAS Plan is needed even in the absence of any growth. However, if any degree of expansion of traffic activity is encountered, the improved and upgraded system must be in place to handle it.

With regard to forecasted growth, we announced at the recent Eighth Annual Forecast Conference that we expected the industry will rebound from the losses in the past several years and will outstrip the growth of the general economy in the 1983-98 time period. We expect our air traffic control facilities to regain their pre-strike operational capabilities by the end of this fiscal year. From there, operations at airports with control towers are expected to grow from 56.4 million to 99.7 million in the 1983-94 timeframe. IFR operations handled by the en route centers are forecast to jump from 23.3 million to 41.6 million over the same period. The number of active pilots will increase from the current 776,000 to just over 1,000,000. General aviation aircraft will grow from 215,000 to 315,000, and their hours of operation will increase from 43 million to 66 million. We believe that all of the capabilities we can build into the new system will be well utilized by a revitalized aviation community.

To summarize, I believe the FAA is making good progress in implementing the NAS plan. Of course, we will continue to make adjustments as the plan unfolds--there will be some advances and some delays--but I have been quite well satisfied at how few adjustments we've had to make so far. I welcome the continued interest and assistance of the Subcommittee, and look forward to working with you as we move ahead with the airways modernization program.

That concludes my prepared statement, Mr. Chairman. At this time, we would be pleased to respond to your questions.

Mr. GLICKMAN. Thank you, Mr. Helms. Why don't you go back to the table? As usual you did your professional competent job in explaining.

I would like to indicate to you, however, some concern that I have and others who have expressed to me about some program slippages in the NAS plan.

You indicated some areas. I think you said TCAS and Mode-S were on time.

Mr. HELMS. The ASR-9 is also ahead of schedule.

Mr. GLICKMAN. But others are not, and I understand there has already been a 3-month slip in milestones, and maybe that is not an accurate statement.

I wonder if you could tell us if there has been delays, what is causing the delays. Is it footdragging by the Department of Transportation? Is it lack of support contractors? Is it money—OMB problems? Is it technological problems? And where are these problems most acute?

Mr. HELMS. I don't really believe that if one views the perspective of the NAS plan that we could identify that type of slip. There are individual elements—yes, there is no question about it. But, again I go back to when President Kennedy announced that within the next 10 years we were going to put a man on the moon, we didn't even start the Apollo exploration package for 6 years.

So, we are in the first year of shaking down a very long-range and long-term program. There have been slips in some of the elements. There have been some pulled forward.

As to the reason for those, I think probably we weren't quite able to digest all that was put on our plate in the first year.

There have been so many RFP's, and I have just been rigid in that we are not going to issue an RFP, until we know what we are buying.

So that I think that the size of our staff working out with the Office of the Secretary of Transportation and the staff there how we will handle the large number of procurements going through,

and the TSARC and ASARC process. That contributed to it. And the advanced automation program—there were three items that were the major contributors there.

First, Congress requested OTA to review the computer program. It didn't take many of our people, but it did take our talent, so we had our talent tied up for 2 to 3 months on that.

Then, there was a request for the Office of Scientific Advisor to the President to do an evaluation, which was a proper thing. I take no exception to any of these. If I were in the Presidency or in OMB or someplace, I would kind of like to have somebody else other than the Administrator of the FAA telling me that it is all right, also. That took our talent for 2 or 3 months.

Then, finally, we had an extensive review by GAO as to the host computer program.

With individual systems, programs, yes, we are behind. The overall program, however, is not particularly behind, and I think that we will find that as the items move into production phase, we will pick them up, and we will be right back on the schedule.

Mr. GLICKMAN. OK. Well, in line with that, I understand that the program office is only partially manned, with 32 out of 55 slots filled. Is that correct? And, if so, with contracts about to be siponed, how do you think you are going to be able to manage this program in the short term?

Mr. HELMS. Those numbers are approximately correct. However, during the same time period by contracted effort, we increased the Mitre level of support, so that we have staffed totally to the level necessary. That is, we have been using the Mitre people who are technically competent, to help us develop the program in this role.

They have helped us during the time period until we get the systems engineering and integration contract aboard. We don't want to build that effort up too large, and, in addition, we have contracted with RCA who has a contingent to help us in the advanced automation system.

So, we have used individual contracts on individual programs. Now, it is time that we pull them together into a total system design.

I would not want to see the FAA expand its employment and go up into a large number. I think we are far better off using the private sector.

Mr. GLICKMAN. So, the fact that you haven't filled 23 of your slots you are saying that in itself it is not significant, because you have used the Mitre folks to actually do that work.

Mr. HELMS. Yes, sir, I don't say that I am happy about it, but I don't really think that that is a significant item. We have been able to use the private sector; Mitre, RCA, and two or three other contractors on assignments until such time as we could complete our work statement for the systems engineering and integration contractor.

Mr. GLICKMAN. Now, the program plan calls for use of certain support contractors. For example, independent software verification and validation support—where do you stand in obtaining this support? And, have these contractors been brought in and shouldn't they have been brought in at the beginning, let us say?

Mr. HELMS. We wouldn't—for example, in the IV and V software, we wouldn't really need them to start the evaluation for 2 years, because if you recall the schedule on the advanced automation system, it moves into three phases.

First is the procurement of the host computer. You have to make sure it works and is reliable. Then, approximately 2 years later, introduction of the sector suite—making sure they are in and reliable, but, the introduction of some of the software. Third, then, is the software.

There is quite sufficient time for the systems design—that is, the systems engineering and integration contractor to pick that up. He may elect to select the IV and V software subcontractor. We intend to put all of that within his authority.

He is going to have a mission-oriented contract—not just an arms and legs or task assignment. So, that will be an integral part of his contract.

Mr. GLICKMAN. So, you aren't concerned that these were not brought in then right away. You think that it was not appropriate to bring them in right away.

Mr. HELMS. It would be too early now, because we wouldn't have any software available for them to start verifying.

Mr. GLICKMAN. OK.

Mr. HELMS. I make one exception to that. That is in the advanced and automated flight service station. In that area, it is highly dependent on software, and that program did get behind, and we in FAA found it out.

We did an evaluation, and in reviewing it with the prime contractor, he did make the change, and that program is now on schedule. It was not of the size, however, that IV and V, of the type the chairman is referring to, would have been necessary.

Mr. GLICKMAN. OK. Last year the NAS plan called for consolidation of existing approach control and enroute facilities into 30 hubs and 18 centers which, I think, is what we saw.

Now, it looks as if you plan to consolidate into an unspecified number of area control facilities. Can you tell me the difference in concepts and the reason for the change?

Mr. HELMS. Yes sir. There were two things that were really the driving force. First, we found that we hadn't gone far enough in what the state of the art would support in automation and communications when we did the first NAS plan.

All along I have said we cannot take technology risks, and that was the ground rule. During the second year, keeping in mind we have now had another year to study it, we found that we could go considerably further than we thought at that time.

During the same time period, it became evident that if we phased out centers and phased up hubs, it would have a significant impact on our personnel.

The National Airspace Review showed that we could have more effective and efficient control of the airspace if we provided an area control facility which would exercise control from the surface to 24,000.

An ACFB, which would be from 24,000 to infinity——

Mr. GLICKMAN. ACF being area control facility.

Mr. HELMS. Area control facility, yes sir. We could resector within those and have better control.

One of the objectives we have had is to take a specific airplane, take its best descent speed for fuel consumption, and give the pilot, then, the authority to start his descent at the proper time out.

A nominal value for a 727, at the average flight and gross weight it has, at 33,000 feet, he should start his letdown 137,000 miles out. Now, with the air control facility and changing the airspace structure to this type of what you mentioned, we will be able to do that.

It was the combination then of finding, as a result of the National Airspace Review, and you will recall it is really predominantly composed of users, and the fact that we now had the automation communications capability, it had a significant reduction on impact on——

Mr. GLICKMAN. How many of these area control facilities will you be needing?

Mr. HELMS. There will be 23, sir.

Mr. GLICKMAN. 23.

Mr. HELMS. Yes, sir.

Mr. GLICKMAN. OK, I am going to ask just two more questions and then proceed on with Mr. Carney, but I want to ask you. You mentioned the human element in this thing. How are things going with your controllers? I guess this is the best way I can ask this question, because, you know, it is obviously relevant for us in terms of the frontend R&D money and development of this monumental change with the FAA if you are continuing to have problems—management/labor problems—and so I thought you might welcome an opportunity to say how things are going.

Mr. HELMS. Well, I am sure that we haven't solved all of our problems. As I told the Secretary in May 1981, we can start out, but it is going to take 5 to 7 years to restructure the thinking philosophy to bring it back.

I believe that it is moving along much better than I had anticipated 2 years ago. The participation, not just by our air traffic employees, but by all of them, except in the case where two of them—members of bargaining units—and their contract, unfortunately will not allow them to participate.

We did approach the unions and ask them to let these people participate in the human relations committees, and they would not agree to this.

So, it is unfortunate, but we are doing everything we can to still respond to the needs of those employees. Basically, the activity has picked up; we have completely revised training in effect for all of our supervisors. Newly selected supervisors have to pass the initial training now. We have facility advisory boards. When there are new items that are to be put into a center or other facility, these advisory boards made up of the controllers themselves sit down and discuss them.

We only have two areas now, in which there is regular overtime—that is Chicago and New York. They do not have compulsory overtime. Overtime is voluntary. Every controller will get at least 2 weeks off this summer if he asks for it. Some of them don't want it. They prefer to wait until the fall or other times of the year.

In many of the areas last year, they had 3 weeks off. They will this year. In April—when we have the drawing as a matter of fact next week for slots—we will disclose additional capacity, and I am holding some back for training.

So, basically, the system is recovering quite well. It is on schedule. I believe that our human relations program is starting to pay off. I have asked Dr. Jones to bring his committee in on the 28th for 2 days, in which I will now present to him what we have done the last year, and ask he and——

Mr. GLICKMAN. This is Dr. Jones of the Coleman Co. that did the original study.

Mr. HELMS. Yes, sir. They did the original study. The entire team is coming back in to spend 2 days with us, so that we will show them what we have done. They can give us their appraisal as to now whether we are starting to address the problem.

It is all right for me to say we are, and for my people to tell me we are. But I would like to have that group tell me whether we are or not.

Mr. GLICKMAN. Well, I haven't necessarily heard anything to the contrary, but recently the NTSB made some—oh, I don't know whether they were recommendations—but they had some concerns about spacing of aircraft, I believe, at some of the airports—and there was a kind of implication there that may have had something to do with adequacy of controllers. I don't know whether you would care to comment on that or not.

Mr. HELMS. Well, I really highly value the input from NTSB and anybody else who can help me figure out a way to keep this system safe and make it better. So, I don't take exception to their statements in any way.

As I recall, they were concerned about the quality effort. Unfortunately, they didn't know that we had this large program that had been underway going back to May 1981, so that we didn't have as effective communications between our organization and theirs as perhaps we should.

They were also concerned, I think, about a controller who may have been certified in the morning and in the afternoon was giving OJT.

What they didn't realize, of course, is that in the past that controller didn't even have po be certified for training. He does now. There are additional restrictions on the controllers now that did not exist then.

My greatest concern right now is that we do not allow traffic to build up to the point where we start seeing aircraft in stacks, and this group of people that we have trained in the last 2 years have never seen a stack of aircraft in a holding pattern.

We had the first situation occur yesterday in the Chicago area. An unanticipated spring storm came through. It closed O'Hare for awhile. South Bend had 9 inches of snow, but the important thing from our viewpoint was that, there was an area of about 400 miles by about 200 miles that was thoroughly clobbered by the storm.

Before we could get the stream shut off, we had quite a few aircraft in the holding pattern. I felt kind of good that our new controllers handled it, but I didn't feel comfortable with it.

So, that is the only thing that I think we will have to do—just be slow there.

Mr. GLICKMAN. One final question before I move on. What is the status of the employees that were terminated? Are you rehiring any of those employees?

Mr. HELMS. If the MSPB—the Merit System Protection Board—hearing is such that they say we made an error, yes. I am not exactly sure, I think there are about 160. I'll get the exact number and furnish it for the record. Out of 11,400, I have no doubt that we made some administrative errors and where we did we're bringing them right back aboard.

In some of those cases, we have had to move them. The feelings are just too strong. These feelings have not died out, and we have had to move them to other locations. In other locations, it has just gone as smooth as can be, and the work force is there, and they put it behind them, which is what I am trying to encourage them to do. August 3 is behind us. Just look to the future.

Mr. GLICKMAN. OK, Mr. Carney. I may have some more questions later, but I have been monopolizing.

Mr. CARNEY. Thank you very much, Mr. Chairman. I ask unanimous consent that I may submit for the record my opening statement immediately following yours.

Mr. GLICKMAN. OK.

Mr. CARNEY. Thank you, Mr. Chairman.

Mr. Helms, I was wondering if you could bring a little bit more enthusiasm to this. We go to an awful lot of hearings, Mr. Helms, and I have to say that unfortunately, too frequently, the briefings are dull, and there is a lack of enthusiasm. That is not the case with you, and I appreciate that very much.

Mr. HELMS. That is very kind of you, Mr. Carney.

Mr. CARNEY. Nonetheless, before you stated that TCAS demonstrations are ahead of schedule, and two manufacturers are now ready to release production drawings.

Will these systems merely warn the pilot of nearby aircraft, or will they also advise the pilot of appropriate action to take?

Mr. HELMS. Basic TCAS–I will alert the pilot that there is another aircraft in close proximity. But this can be enhanced depending on which of the elements he buys.

For example, I am going to use the analogy of a car. You can buy the basic automobile, then if you want to, you can buy a radio and then you can buy air-conditioning, and you can buy the other items. You can buy basic TCAS–I, then if you wish, you can buy that section which will print it out, and if you wish you can have one that will tell you which o'clock position from you that aircraft is.

But, TCAS–I is basically a proximity warning device that says there is another aircraft within a given distance. TCAS–II will give you the bearing from that aircraft, and, in fact, will tell TCAS–I which way he should turn to avoid the possibility of a conflict.

When I say, "tell," that is an advisory notice. The captain of an airplane is just like the captain of a ship. He must make the determinations, finally. We are not trying to change the regulatory aspects at all.

Mr. CARNEY. That brings up my next question. Do you believe these systems will be reliable enough that the pilots will follow the advice even when they can't see the other aircraft?

A lot has been said in the past that pilots, although they might be supported by these collision avoidance devices, they are going to rely on their own instincts, and when they couldn't see anything, they perhaps would not respond to these advisories. Do you think that the success of TCAS is known well enough that the pilots will have enough confidence in it to follow the advisories?

Mr. HELMS. I think that aside from my personal opinion the only data points I have are two. When these were first installed in Piedmont Aircraft, the pilots were very hesitant about them. They were reluctant to have much confidence in them, and, in fact, they were installed in the flight engineers panel.

Over a period of the 900 hours that were flown, and after the 26 intruders that the TCAS identified that they hadn't seen, that mood changed very rapidly. Now, those pilots have formally requested us to install them up front so that they can see them.

This is phase II of the development program. In addition, I have the presidents of two air carriers and the pilots of three air carriers have asked us to let them have some of the next quanity we procure so that they can get accustomed to using them.

So, with that very small data bank, I have a feeling that as the pilots use them and see them, that, yes, they are going to have confidence.

I would go one step further. I recall when radar first came along. Pilots weren't about to have some electronic device on the ground tell them there was another airplane nearby. I recall that when encoding altimeters came along, they resisted.

Pilots get confidence when something works, and it is demonstrated.

Mr. CARNEY. What are we talking about for the TCAS-II Cadillac-type package regarding cost?

Mr. HELMS. About, roughly $60,000. Between $50,000 and $70,000.

Incidentally, they will make that up in fuel savings on direct flights in less than 90 days, if they elect to go that way.

Mr. CARNEY. That sound great. On another subject, how are you approaching the need for more technical training and support for the modernization program—the NAS modernization program?

Mr. HELMS. In January 1982, I initiated a program by making contact with a number of universities asking them to consider a new airway sciences degree. I laid out what I thought we were going to have to have.

At one point when, we had slightly over 9,000 controllers, only 14 percent had baccalaureate degrees—at a time when we were moving into a highly technical business. We now have several universities that will turn out their first baccalaureate degrees next fall—1984—in the new airway sciences degrees.

We have even more that will start to turn them out in the following spring. We have, I believe, 18 universities that are in the final stages with them of nailing down the curricula.

The curricula is such that I wanted the first 2 years to be heavily oriented into social sciences—getting along with people—and math, sciences, some aviation, and general studies. The third and fourth

years move quite heavily into optimal areas of study, or majors—electronics, computer sciences, and so forth.

It is a hard degree. It is not an easy degree to get at all. There are about 40 hours in each of the five options, but all the options are technical options. They are not—I have nothing against music—but music appreciation is just not one of them.

I am trying to train a group of people to help modernize the airspace and that program is well underway.

In addition, we have initiated a program of self-education in the FAA that our own employees who now want to start taking courses will be encouraged and helped.

We now have 61 co-op students in the southern region alone primarily minorities and women whom we have been bringing along to get them into the program. I have even looked for a woman's university to get them aboard the program.

The third program that we have is an aviation educational program that has been initiated. It will be picked up nationally this summer, and will be working with some of the other organizations.

So, we are pretty well underway on a program to educate this next generation. This program has been given a tremendous boost by the President himself, and he agrees that education is the thing that is going to help the Nation get going.

So, he is firmly behind it.

Mr. CARNEY. I am pleased to hear that. I have a question. I am not sure if I am right in saying this, so the best way I can phrase it is I have been told that your organization has the fewest women in supervisory capacities of any Federal organization.

I don't know if that is true or not, but are you or do you have programs designed to integrate women into the supervisory and managerial capacities?

Mr. HELMS. I suspect your information is correct, Mr. Carney. I don't know with certainty, because to a great extent—and this reflects some of the criticism that has been leveled against us in the air traffic control particularly where we had a very high percentage of military people.

But, starting 2 years ago, we definitely started changing that. Our facility manager now, in the Boston Center, one of our largest, is a lady. Our tower chief in Long Beach is a lady.

Mr. CARNEY. What?

Mr. HELMS. The Long Beach, Calif., tower chief is a lady, is a woman.

Mr. CARNEY. Tower, I am sorry.

Mr. HELMS. In California.

Mr. CARNEY. I thought you said tire chief.

Mr. HELMS. No, no, no.

Mr. CARNEY. That is why I said, "What?" I am sorry.

Mr. HELMS. Tower chief. Our facilities chief at Battles, Alaska, is a woman. We have been moving more and more into this recently, and we have increased our percentage of minorities also.

It does take time, but we have been moving out on it with a very formal program to do so, and I have no reason to believe we are going to back off.

Mr. CARNEY. Well, the formal program—I don't know if I should call it formal—but your degree program, I would think will bring

you away from what I think was traditional in your organization, a reliance on to the military for people perhaps getting their basic training——

Mr. HELMS. Yes, it will. The one university, I think you might be interested in, will graduate airway sciences graduates in 1984 and there are 1,100 students that are in that school now, and the last figure I had was that 25 percent of them were women that would be available to come into this program.

So, I am doing everything I can to bring women into the mainstream of the program.

Mr. CARNEY. Which university is that?

Mr. HELMS. North Dakota.

Mr. CARNEY. University of North Dakota?

Mr. HELMS. Yes, sir.

Mr. CARNEY. Well, I have no further questions of you, Mr. Helms. I just hope that whatever you need we as a committee can help you, and I am sure we will in Chairman Glickman's reign here.

I hope your enthusiasm is such that it goes throughout the entire organization.

Mr. HELMS. Thank you, sir.

Mr. CARNEY. It has been a big change. I have been on this committee for 4 years, and there has been a big change in FAA in that short period of time.

Mr. HELMS. Well, I happen to feel I have a very good management team now, and they are aboard with me, and we are going to make this thing go.

Mr. CARNEY. Thank you.

Mr. GLICKMAN. Mr. Boehlert.

Mr. BOEHLERT. Thank you, Mr. Chairman. I would like to identify with Mr. Carney's remarks. When I listen to you, I often feel that you are on automatic pilot with facts and figures. It is very impressive, and I hope it is contagious in terms of the rest of the people in your organization.

I am particularly interested, as you know, in the flight service station and automation and consolidation program. Where are we right now, and where are we going, and when do you expect to get there?

Mr. HELMS. There are 317 of the flight service stations which will be consolidated into 61. The sites for the first 13 have been selected. We are in the competition process for the others, so that it is not automatically put into a large industrial complex, but it gives many municipalities a chance to bid and be considered for it.

In fact, most of them have gone to the smaller communities. These are set out by regions, and by that I mean geographic regions. We usually announce this 6 months in advance, and then have a meeting and give the people a chance to prepare their proposals.

We are figuring on selecting about two a month and we will be moving further across the central part of the United States and to the western part during this year.

I think that the final sites are to be selected by late spring of next year. Construction is underway on the first two that were awarded—in Indiana and Bridgeport, Conn.

So, the program is moving right along. We will be somewhat delayed, however, in installing the new equipment. That will not prevent us from going ahead, however, with the consolidations, because we can remote the lines then. To insure that we are providing adequate service, we have started now on a national basis, the State-by-State establishment of a series of 800 lines with numbers, so that as an example, in Kansas, if you dial one number for a flight service station and it is busy, you can immediately pick up the 800 line and dial any one of seven other numbers.

We have been testing that to see that people can get a response. We have done this to make sure that the pilots are not left hanging loose during the process time.

Mr. BOEHLERT. For the flight service stations, you talk about the bidding process. Is it a one-time bid, or is it a negotiated bid?

Mr. HELMS. No, sir, it is a one-time bid. This is done right along with Federal procurement regulations and based upon a set of criteria which includes the leasing cost of the building. Some criteria, for example, are that it must be on an airport. There must be an acceptable cultural environment for the employees—that sort of thing. But, we don't have any problems with that.

Mr. BOEHLERT. There is some subjective analysis involved in the overall selection process, isn't there?

Mr. HELMS. Yes, sir.

Mr. BOEHLERT. How do you qualify the cultural aspects—the quality of life available?

Mr. HELMS. If we had, for example, a community of 900 people with an airport, when they submitted their bid we would tell them that unless you can show that you have adequate schools, recreation, those things for our employees, we won't accept your bid.

We are allowed to do that to make sure that our employees are not put into an environment which is going to be detrimental to them. We don't have a problem with the process.

But, I am only using that to show that we do have that capability to insure that our employees are thought of also. Basically, the bids are based on square footage cost per year, telecommunications cost, cost of moving the employees from the various sites to their—insurance, utilities, janitorial services, and I think there must be one or two others. The majority of the criteria items are things that we can quantify.

Mr. BOEHLERT. Are you having on-site inspections?

Mr. HELMS. We always do in every case. Yes, sir.

Mr. BOEHLERT. OK. Is that just for the finalist or all who bid?

Mr. HELMS. If we have 10 or less, we will go to all of them. If we have more than that bid, then we will probably take the 10 low ones and visit those 10.

Mr. BOEHLERT. All right. Thank you.

Mr. HELMS. Yes, sir.

Mr. GLICKMAN. Mr. McCandles.

Mr. MCCANDLES. Thank you, Mr. Chairman, I apologize for not being here earlier, but my presence was required over in that other place.

Mr. GLICKMAN. Yes, sir.

Mr. MCCANDLESS. This afternoon—where we're spending money unfortunately. Mr. Chairman.

Mr. GLICKMAN. Why are you looking at me when you say you are ending money? I mean that in humor. Taxpayers don't, but I do.

Mr. MCCANDLESS. Most of the questions that I would have asked ave already been asked, Mr. Helms, where my interest has been rved. However, I do have one question. I understand regulations verning some flights, particularly over-water flights, might be anged.

Is there any comment you would like to make on these regulaons—how they might change and how this might affect the over- l picture?

Mr. HELMS. I am sure you are referring to the requirement of in engine aircraft and their use over the ocean. The ICAO rules, ternational rules, are the twin engine aircraft carrying passenrs may not operate more than 90 minutes from an acceptable airld.

The United States uses 60 minutes, so first we have a slight difrence from the rest of the international community. That is not cessarily bad; it just says that we are more concerned in the nited States.

With the advent of the new family of jet aircraft, there is now e question of whether we really need to keep that rule, and does diminish safety if we now allow twin-engine aircraft to operate er water.

We have a dual program underway. I started some months ago side the FAA to examine it and see what the impact would be. hen, I have given manufacturers the freedom to do the analysis hich they would like to do and convince us, also.

There is some validity in changing. For example, that rule specis on the number of aircraft, but mathematically if you had four ston engines on all the aircraft that you have to fly across the orth Atlantic, you would have perhaps an eight times probability at you would lose two of those four engines, and you would have day losing one of the jet engines. This is because the reliability of e jet engine is extremely high.

Oddly again, it is not the engine that has me concerned. It is the bsystems—electrical system, the pressurization system and the ectronic system.

So, I have asked the manufacturers to go back, show me what anges they would put into the aircraft in the form of redundancy the subsystems to bring it up and demonstrate that level of reliility we would like to have.

We, on the other hand, have started to take a look at what ings could be done to make this come about. This is of significant nefit to the traveling public, because we are talking in terms of ving $400 to $600 million a year in the North Atlantic alone if in-engine aircraft could do that.

By putting in an ILS set at Sundstrom on Greenland, putting in CAT II system at Goose Bay, and one other one, we would then ve the capability to operate down to CAT II minimums, and erefore we can meet not only the 90-minute rule, we can meet e 60-minute rule.

These are things that I am starting to look at now, and I don't nk I'm going to be prepared, until late summer. It takes me

quite a bit of time to go through this type of review but I am seriously evaluating it.

If I am confident that we can have the equivalent level of safety, then I will be prepared to propose a change to the regulations.

Mr. MCCANDLESS. Thank you, Mr. Helms. Thank you, Mr. Chairman.

Mr. GLICKMAN. Let me just ask you a couple of things in addition, Mr. Helms. Last year the Congress authorized $1.393 billion for the facilities and equipment budget for the FAA in fiscal year 1984. Why did the administration only request $1 billion when the authorization was based on good faith agreement with the users, in which there was agreement to support the new tax levels in return for assurances that the money would be spent?

Mr. HELMS. When I prepared the FAA budget this year in its original form, I did request the $1.393 billion just as had been outlined. The slippage that we discussed earlier in the host portion of the advanced computer program. Was about 90 days which took it out of fiscal year 1984 and put it into fiscal year 1985. Therefore, the economists noted that I didn't really need that amount of money now, because you can slide it into the next year.

That was a valid observation.

There were two or three changes like that which came about and allowed us to keep our overall program on schedule at the one billion level instead of the $1.393.

On the other hand, had we been asked could we move other parts of it forward and bring other parts onstream sooner and come back to the $1.393 level, the answer would have been, "Yes." We have programs identified that would come out at about $1.32 or $1.34.

So, the reason for the decrease was the fact that three of the programs slipped into another fiscal year.

Mr. GLICKMAN. But, the OMB did not permit you to slip additional programs forward then.

Mr. HELMS. No; they didn't give me that opportunity. No, sir.

Mr. GLICKMAN. OK. I guess I would again reemphasize our concern that with the kind of deficits we face there will be more and more pressure by OMB to get you to slip in other areas as a convenient source of revenue.

I would hope that from what you have told me that you verify that you are not going to, in any way, let this program slip further as a means to let the budget for the United States to look a little bit better.

Mr. HELMS. My own plan—and very firmly, and Mr. Stockman talked with me about it—is that that amount that slips will be put back into either 1985, 1986, or 1987, at the appropriate time that it comes in.

I don't intend to defer it at all. We made that commitment to the Congress. We offered that any way you can lock us in, we will do it, and as far as I am concerned, we are going to go right ahead with the plan as outlined.

Mr. GLICKMAN. OK. because I know that other committees of Congress feel as I do--Mr. Minetta, who chairs the Public Works Subcommittee—you know, we don't want to see OMB pull any

monkey business on the users who pay in terms of ticket taxes or gasoline taxes.

Mr. HELMS. Well, I found that every person is a prisoner of their own experience, Mr. Chairman, but to a great extent, I must say that Mr. Stockman bears a bum rap.

I have found, without exception, the four or five times that I had a major problem, that I went to Mr. Stockman and pointed out. "Look, I can't live with this because."

He has been both responsive and been able to work a way out to help me out.

Mr. GLICKMAN. You are one of the few people who has an intellectual capability as high as maybe he thinks his is, so you are able to work with him. OK. I am glad you are here on this job. That is all I can say.

Let me ask you—you mentioned something else—regulation by negotiation. You mentioned last time we were here, the code word was regulation by objective. What has happened to that, and is this a replacement for that?

Mr. HELMS. No, sir. One of the numerous surprises I have had in coming to Washington is the fixation of the mind—that we don't try anything new until it looks bad. There is very little preventive maintenance or looking forward to the future.

Regulation by objective is, I still believe, a far better way for carriers to approach other methodology for the same level of safety. But, if they don't want to do it, we are certainly not going to try to force it on them.

If the air carrier industry and the others say, "No, we don't want to fool with it," it will come to a halt.

That should not prevent us as an institution—not us the FAA, but us the government and the Congress—from looking for other ways to simplify the regulation process.

When we can find those areas where all of the participants can get involved in it, we stand a far better chance of making a regulation that we can all live with.

So, I believe that as an institution, the Federal Government and the Congress should try regulation by negotiation. Let us see if it will work. We won't know if we won't try it. So, I am willing to stick my neck out.

Mr. GLICKMAN. All right. Tell me how this is going to work again—regulation by negotiation.

Mr. HELMS. We will probably create an advisory committee, and it will be open to the public. Representatives of all affected interests will come in, for example, and outline what they think a flight and duty time rule ought to be.

Each of them can hear each other. In the case of the FAA, we only have one interest—safe and efficient use of the airspace. I am hoping that we can get this group together and negotiate a flight and duty time regulation that meets the needs of all of them, gives them the protection they want, and allows us merely to codify it, issue an NPRM it, and have public comment.

But, we won't know if we don't try. that is all I want to do.

Mr. GLICKMAN. Just as long as you don't abdicate your responsibility———

Mr. HELMS. Oh, I am not going to do that. That is the reason I said "safe and efficient use of the airspace." I would clearly have to say that if they came up with one that violated our mandate for safety, then I couldn't go along with it.

Mr. GLICKMAN. When do you—You say you are going to plan to at least try it on an ad hoc basis.

Mr. HELMS. Well, we would invite interested groups to come in and participate in it, I haven't formalized all of it yet; I have a group working on it—but, for example we would Probably ask each of them to summarize what they think are the pertinent points of flight and duty time.

That will be the jumping off point, and, we'll start talking about it that way. Let some people come up with this. The reasons—when the flight and duty times were originated—many of them, of course, were the old Pan Am Clippers. A plane doesn't know whether it is flying in night or day. It doesn't know whether it is flying over water or land anymore.

If it is so safe that we can go to a twin engine, why should it make any difference whether you are flying over water or land with regard to flight and duty time.

Those are the sorts of things I would like to have people sit down and talk about. Let's bring it up-to-date.

Mr. GLICKMAN. Now, let me ask you about setting up an Advisory Council of outside experts dealing with NAS and computer-related issues. Where are you on that?

Mr. HELMS. First, so that I can put it into perspective for the other members—while I have confidence in our FAA management team; I don't think I have ever seen this group focused in on one point—nevertheless, we will have the systems engineering and integration contractor first.

Now, my concern is that while that gives us technical continuity, there should be some form of overview to reaffirm that this program is carried out the way we presented it to the taxpayers who are paying the taxes, and the users, and the Congress.

So, my present plan is that we will have a group—and I have to be careful whether it is going to be a committee or a board because that is what affects what you have to do to get it approved by OMB. But, there is going to be some kind of reviewing group made up of seven people—one of them from the FAA (that would be me). The others would be from the outside that would meet four times a year maybe—not less than two.

As the systems engineering and integration contractor gave his quarterly status presentation to the ASARC to FAA, and to OST, this group would look at it and give us an independent assessment of whether the FAA is still on the path that was charted in the NAS plan.

This will give us the continuity over the next 6 to 8 to 10 years to make sure that this program stays on track. That we are implementing what we said we are going to do.

The type of people that I have talked with about this—Dr. Pickering at JPL—I wanted someone who had extreme experience, in-depth experience in marrying longrange communications and computers. He has done as much as anybody.

I wanted somebody who has integrated complex and diverse systems—Dr. Chris Craft at NASA in Houston. I wanted someone who had experience in avionics, the airborne equipment—Dr. Bill Firestone. So, it is those type of people that I have talked with to pull together. They will form this committee and look over our shoulder to make sure we keep doing what I have told you and other committees we are going to do.

That is the reason for it.

Mr. GLICKMAN. OK. I think that is an extraordinary idea, and if I——

Mr. HELMS. If we have those underway by the end of this year, then I will feel that I will have institutionalized it to the point where I do not worry about me not being here, Mr. Chairman.

Mr. GLICKMAN. OK, let me ask you this question. We understand that the cost of the small community MLS, microwave landing system, has risen dramatically from the amount originally advertised to this subcommittee.

Can you explain?

Mr. HELMS. For the record, I will furnish the detail numbers so that you can see them. The difference between the 1980 dollars and the 1983 is that the 1980 dollars did not include construction of the equipment on the side and installation.

The program costs—the contingency which is now put in all the programs, the provisions for spares, and the site, and the depot, factory inspection, and the regional cost by our regions to install them—the whole iceberg—not just what the procurement contract calls for are included.

In addition, the design prior to 1980, when we went to automated and remote maintenance monitoring, had no redundancy in the system. A single point failure put it out. It now has redundancy.

There was minimal or no remote maintenance monitoring. It was on-off control, and that was all. It had a rather low equipment MTBF of 1,500 hours. With the redundancy that we have in there now, converting the MTBF to MTBO, it goes to 30,000 hours.

It was limited to runways of 5,000 feet or less, so as the program developed, as it matured during the test program, the design canged somewhat to make it more reliable and beneficial.

[The information follows:]

Mr. GLICKMAN. OK. The cost, though, has gone up for a small community—I guess what concerns me is it is up to about $1 million, I guess.

Mr. HELMS. No, sir.

Mr. GLICKMAN. Isn't that correct?

Mr. HELMS. No, sir; if you want to buy—if there is a small community that wants to buy it, they can buy one for about $350,000. Three communities in Michigan, on their own, are buying them this year. We prefer that they buy the more sophisticated one, but if they elect to, they can still buy the small community one.

Mr. GLICKMAN. OK. Let me go to weather for a moment. I see your weatherman, Mr. Blake, is here.

Mr. HELMS. Yes, sir.

Mr. GLICKMAN. As you recall, the subcommittee was actively involved in weather issues, and you have established kind of a weather focal point to assure reliable weather data to pilots.

I wonder if you might talk a little bit about Mr. Blake's role, why it was established in the R&D area rather than in operations, how much staff he has, what authority he has, just generally.

I think these are things the committee is very interested in.

Mr. HELMS. All right, sir.

The committee will remember that one of my concerns when I came to the FAA was that there was very little rotary wing experience in headquarters. We had no senior executive that had grown up in rotary wing.

As a result of that, we had really not done an adequate job in meeting the requirements of the helicopter group—not just in design, but operations and the whole works. We created a Rotocraft Program Office to pull together.

It took us awhile studying it to see how to do it and how to go about it and to create the equivalent of the Rotocraft Program Office in the Weather Program Office.

Now, at this time Mr. Blake has three people, plus a full-time man from the National Weather Services there.

He will have more if he needs them and as the program is better defined.

The program is just getting underway from what we had. A definitive weather plan that will be completed in July of this year. The reason it started out in engineering, rather than operations, is it is now an engineering problem.

AWOS, central weather processor, the NEXRAD radar are the types of efforts we're talking about. We have to get the technology and the technical efforts pulled together. So now the emphasis is on engineering so I placed the program office in the engineering arm of FAA. It would have been wrong to put it over in operations because they would have had to leap back.

So, what they are doing is setting it up to make sure that there is emphasis and an integration of all these subsystems, and in about 2 years, as the production lines roll, it will shift over to the operations side of the house.

Mr. GLICKMAN. Shift over to the operation area?

Mr. HELMS. Yes, sir, because the problem is is to make sure that that data gets to the pilots. But, to have them try to run a techni-

cal effort at this point—with all the new designs and new equipment—would not have been a good thing to do.

Mr. GLICKMAN. OK. You know, you mentioned NEXRAD. I have heard from some that it is too complicated. The original side of providing weather data has now been circumscribed by other things. I wonder if you might comment on that.

Mr. HELMS. There are a number of ways, perhaps, to get the weather radar in the field. My concern is that we don't take a step back at a time when we are trying to solve this wind shear problem.

I don't know of any other system that is going to do this job for us. It is the only system that I know of that would give us both the enroute coverage and also give us the terminal coverage that we need, particularly in the area of microburst and wind shear.

So, I think my view would have to be that, "Yes, it may be a little complicated, and we may ultimately have to have two versions." I am not sure of that, but I suspect there is going to be to meet both the National Weather Service's needs and the military's needs and our own.

Incidentally, we are very closely coupled with the Department of Defense on this.

Mr. GLICKMAN. OK. Let me just ask you a couple of specific questions and see if anybody else has any final questions.

Is there anything new on icing work—either regulation or R&D—on the part of the FAA? We had made some recommendations. You accepted some of them. You didn't accept others of them.

Mr. HELMS. The most fundamental part of the icing problem is to get it off the wing—the clean wing concept. We don't know of any way that you can write a spec for one type of compound versus another. That is up to the operator.

We do have a major program continuing in helicopter icing. I don't mean to say that we have diminished the other one. Boeing is working on a program for us now on various aircraft types because we are not convinced that there is something unique about the 737. I am not saying that there isn't. I am just saying that we are not able to identify it if there is.

So, we are going back now to take a look at various aircraft to see what the icing criteria are.

At this point the tests which were done on that wing down at Eglund were not conclusive. It showed, "Yes, ice builds up. Yes, you do lose lift from the leading edge buildup." I don't think we got sufficient data out of it to have us quantify whether you lose X or Y percent of lift. It did confirm what we know by extrapolation and prior data that if you stall the tips and you don't stall the root with a swept-back wing, you have moved the CP forward, and, as a result, the airplane is going to pitch up. Mathematics tells us that. I don't know that we got as much out of it as we thought except that it did confirm that there were ways that you could probably structure a test.

We are now looking at a long-range program. It is going to take us about 6 years to complete it—3 years to really get it underway—in which we will make a series of tests with instrumented aircraft under varying instrument conditions.

I know this sounds odd. Here we are in 1983, and there has never been an organized research program in the United States that took aircraft out and measured icing rate as a function of water molecule size and quantified this using an instrumented program which would then allow us to predict what icing would occur for any given atmospheric condition.

Mr. GLICKMAN. What is this? Take an aircraft out? Explain to me what you just said. What does that mean exactly?

Mr. HELMS. Ice, and its rate of buildup, is a function of at least two things: the size of the water drop, and the temperature. We have never had a program which said: "Now, what is the rate of icing buildup for each condition of water molecule size and temperature?"

Now, then, let us continue the experiment by using larger and larger molecules of water. I should say droplets. Now, by measuring in buildup for each size droplet we can develop a prediction system that will allow us to have the capability to predict the kind and rate of buildup of ice. Hence, we should be designing the airplanes for deicing to meet the various conditions.

This is going to take us quite awhile to do, but that program is now being laid out. We have have a program underway on helicopters. That one is of considerable concern to me now, because of blade icing, but more importantly because of icing on the windshield and front of the helicopter which interferes with the pilot's ability to see to land.

It is one great big problem. We are working with NASA and the Department of Defense on that program to try two or three approaches to it. So, I don't think that I can indicate to you that we have solved anything, but I have no hesitance in saying that we have a much more focused approach.

Just this last week, Mr. Blake met again with a NASA group on this area, and we will be working with them more and more to try to find new test methods. One of our problems is that we don't know how to develop adequate simulator tests.

I can't be overencouraging, but I have no reason to believe that the effort which we are undertaking is not going to give us more data and help us out.

Mr. GLICKMAN. Well, your numbers look pretty good in terms of your budget for 1984. In terms, as I look down here, not only in your computer and air traffic control, but in your aviation weather, aircraft safety. We have got some healthy increases there.

Mr. HELMS. Yes, sir, our research and development—OMB went along with us very closely.

Mr. GLICKMAN. Yes, sir, at least I feel comfortable that you have resources more than you have had in previous years to try to deal with some of these issues.

Mr. HELMS. Well, I tried to be an effective salesman over at OMB in that area just as well as my commitment here, Mr. Chairman.

Mr. GLICKMAN. Let me ask you a final question. Of these aviation sciences educational programs, how many schools do you anticipate are going to be offering this program in the next couple of years?

Mr. HELMS. We have 18 now that are in the final stages of discussion. I have no way, of course, of quantifying it. I would hope

RTCA SC-125 SCMLS	F&E BUDGETED MLS
$214,125 based on 1975 dollars	$1,176,800 based on 1984 dollars
Hardware costs based on cost estimates developed by the cost evaluation group during the MLS technique selection process in 1974. Other cost elements derived in 1974 Other cost elements derived from Turnkey ILS cost estimates.	Cost estimates developed by using F&E cost estimating procedures. LCC fully considered
Low cost small community MLS configuration, built to commercial standards, satisfying limited operational requirements.	Standard production configuration, built to FAA-G-2100, satisfying a wide range of operational requirements.
includes:	includes:
* Azimuth, elevation markers	* Azimuth, elevation, distance measuring equipment/ precision
* Commercial manufacturing quality assurance	* Equipment designed to manufacturing quality assurance
* On site spares and test equipment	* Full logistics support included such items as on-site spares, depot spares, documentation, etc.
* Radio synchronization only	* Radio synchronization, fiber optics synchronization and metallic lines synchronization
* Construction & installation (partial turnkey)	* Construction & installation (full turnkey)
* Factory inspection	* Factory inspection
	* Standard system design empasizing commonality of equipment, minimizing training, staffing, supply support, configuration management
	* Standby power (ups)
	* Reliability & Maintainability and redundancy (supports 80's maintenance concept & reduced LCC)
	* Non-recurring engineering
	* Program support

that we could get at least 15, because if we could get—say, 15—and each one of them graduated maybe 30 baccalaureates a year, we are starting to look at 450 or 500 trained people a year available to come into the FAA. I am not going to get them all, as much as I would like to have them.

I have already had to go to a meeting with the ATA Board of Directors and told them for the first 3 years to keep their hands off them. This is the only program that ever trained people for aviation sciences.

We have aeronautical engineers; we have economists; we have marketing people, but we have never had a program before that trained people for the technology of airway sciences, air traffic communications, and electronics, so I am going to try to keep as many of them as I can.

Mr. GLICKMAN. Thank you. Mr. Carney, do you have some follow-up questions?

Mr. CARNEY. Yes, I do, and I'll be very brief, Mr. Helms. One, you showed where you were taking a lesson from another organization in upgrading your control systems and integrating that into your organization. You said that you took a model from an Illinois Telephone Co.

Did you try to find a model within the Federal Government before doing that?

Mr. HELMS. Yes, sir.

Mr. CARNEY. Were there any?

Mr. HELMS. No, sir, the Federal Government has not applied new technology at the level we are trying to use—automation and communications—to hold down on the personnel load.

Tennessee Valley Authority has looked at it rather actively. The Immigration Service has looked at it. I could find nothing that met what industry is doing.

Mr. CARNEY. Would you suggest, then, that this could be used as a model for other Federal agencies?

Mr. HELMS. I have written a letter to Mr. Wright, Joe Wright, the Deputy Director of OMB, and to Dr. Devine—Don Devine—at OPM, recommending that they come over and sit in for this hour and a half briefing that summarizes the effort that I have gone through.

I am sure that we have not done everything perfect, but it is so much further along than anything I have heard before, and our problem, I think, is this. When the government started buying computers, data was expensive—that is, processing capability. A bit of data—you had to pay alot for it.

In the succeeding 20 or 25 years, data is practically worthless. You can buy so much data now for a dime, and labor has gone up. But, Congress institutionalized its purchasing requirements and procedures to the point now where the Government is prevented from taking advantage of that.

It forces us into a bad situation. That is one of things that, collectively, we in the administrative side and you in the legislative side have got to address.

Cost of labor has gone up dramatically. Cost of data has gone down dramatically, so we should be switching our priorities.

Mr. CARNEY. In my final question, could you tell me what service means? Could you tell me what ATSCCP means? What DDM means? And what FDDL means?

Mr. HELMS. Service. I don't know how the expression is used.

Mr. CARNEY. It is an acronym: CIRVIS.

Mr. HELMS. CIRVIS? No, sir, I can't answer that one. What was the next one?

Mr. CARNEY. This page of acronyms comes from a list provided to us by the FAA just a few days ago. I just wanted to demonstrate the problems that we have.

Is there anything you can do to correct this?

Mr. HELMS. Your point is unmistakably and well made, Mr. Carney.

Mr. CARNEY. Thank you, Mr. Helms.

Mr. GLICKMAN. Mr. McCandless, do you have any other questions?

Mr. MCCANDLESS. No, sir.

Mr. GLICKMAN. Mr. Helms, thank you very much. Mr. Albrecht, Mr. Blake—we appreciate your being here.

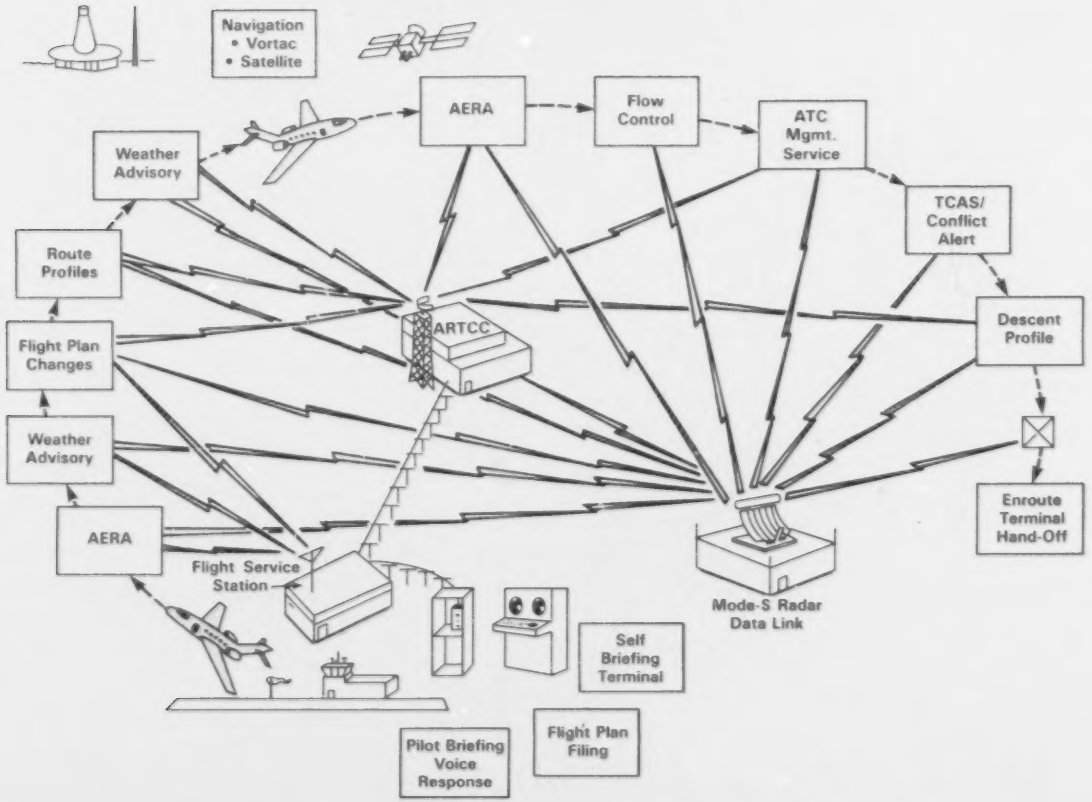
Mr. HELMS. We will be glad to furnish any additional data that the committee requests, Mr. Chairman

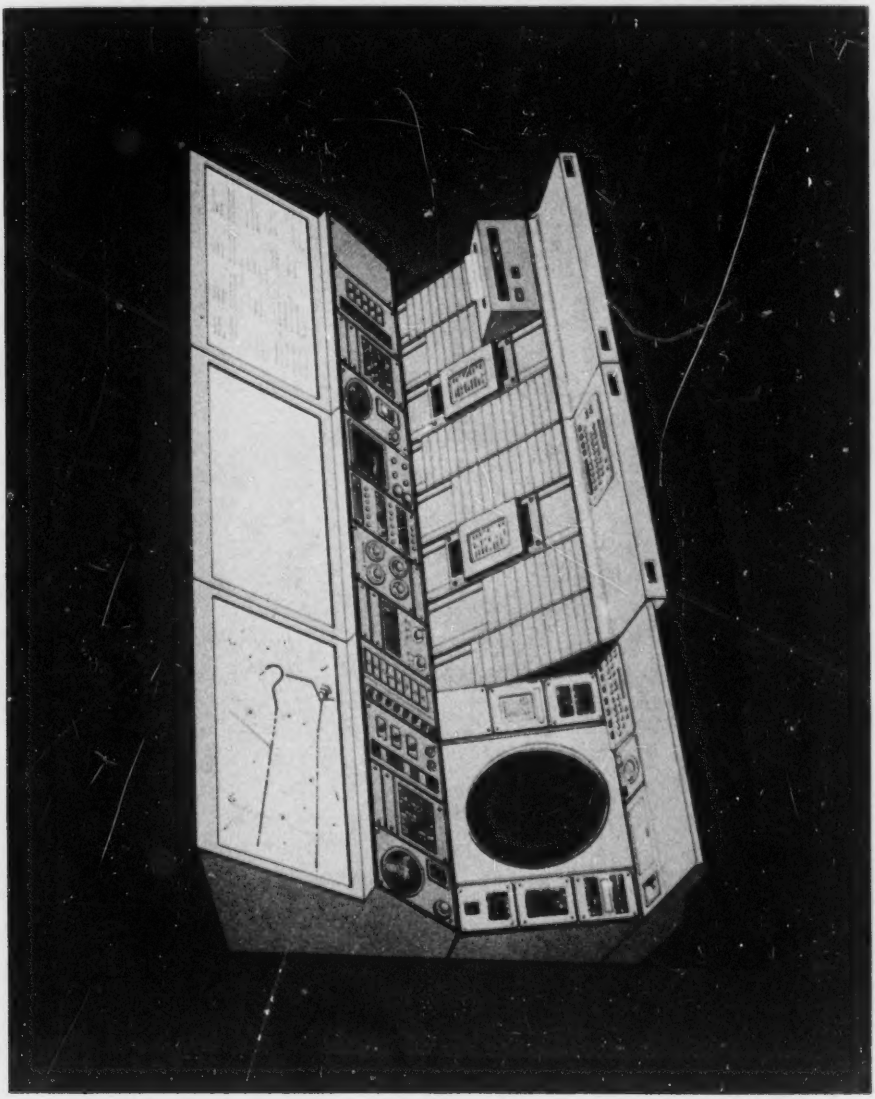
Mr. GLICKMAN. The next meeting of this committee will be a joint hearing with the Armed Services Committee on the JVX Program, the Tilt Rotor program that is being done largely through NASA's work.

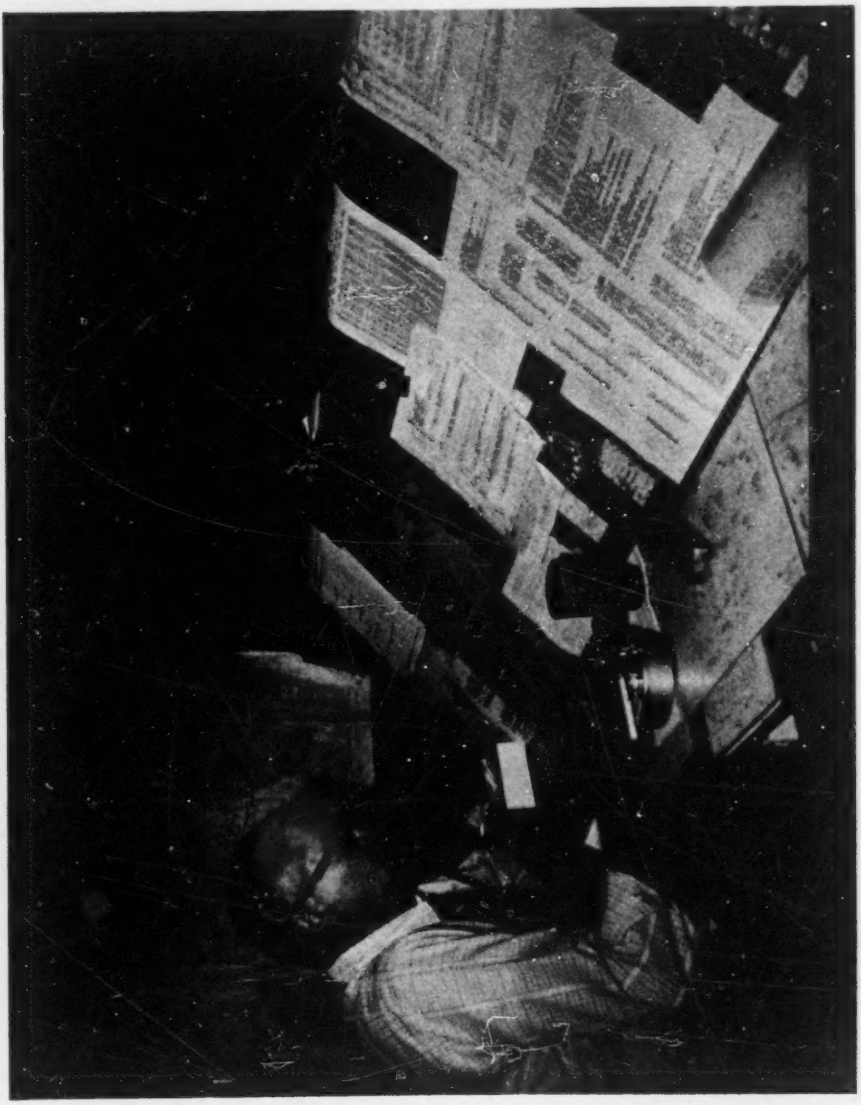
[Whereupon, at 4:04 p.m., the subcommittee was adjourned.]

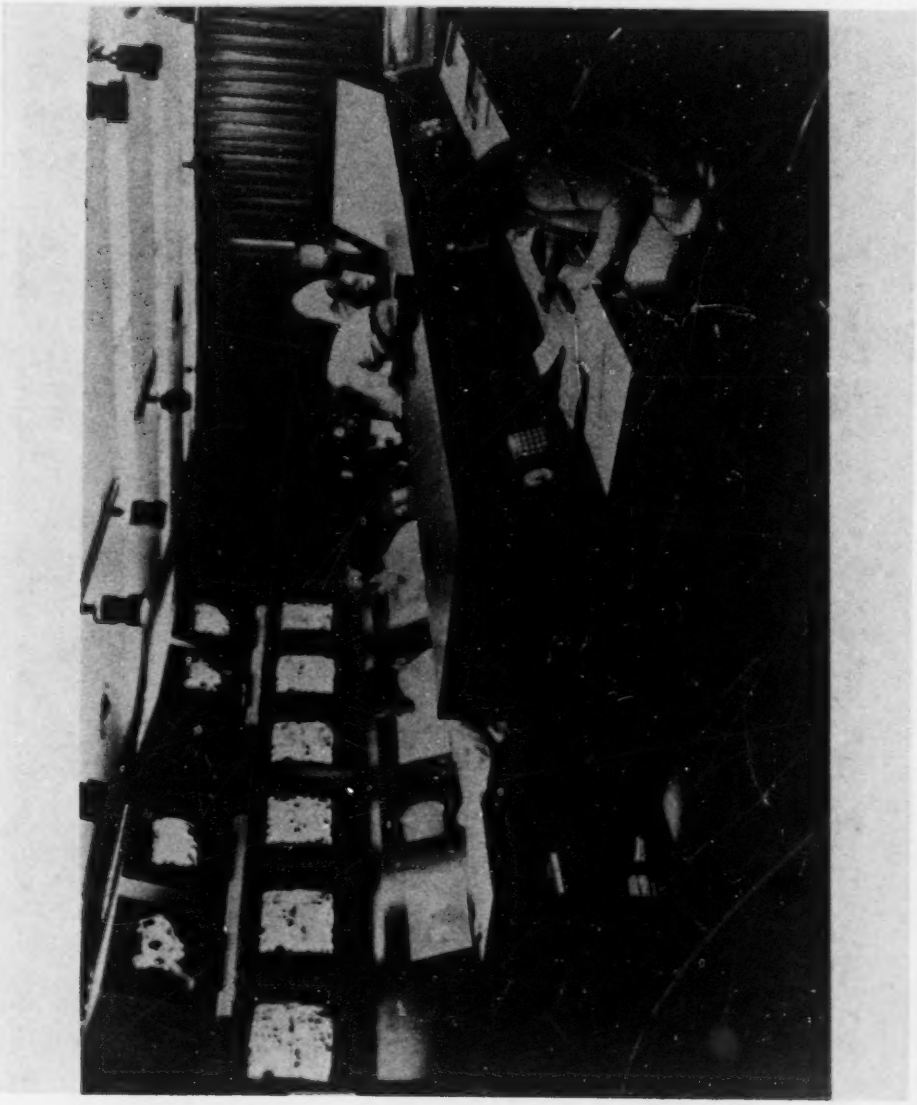
[The charts used during Mr. Helms statement follows:]

Enroute System

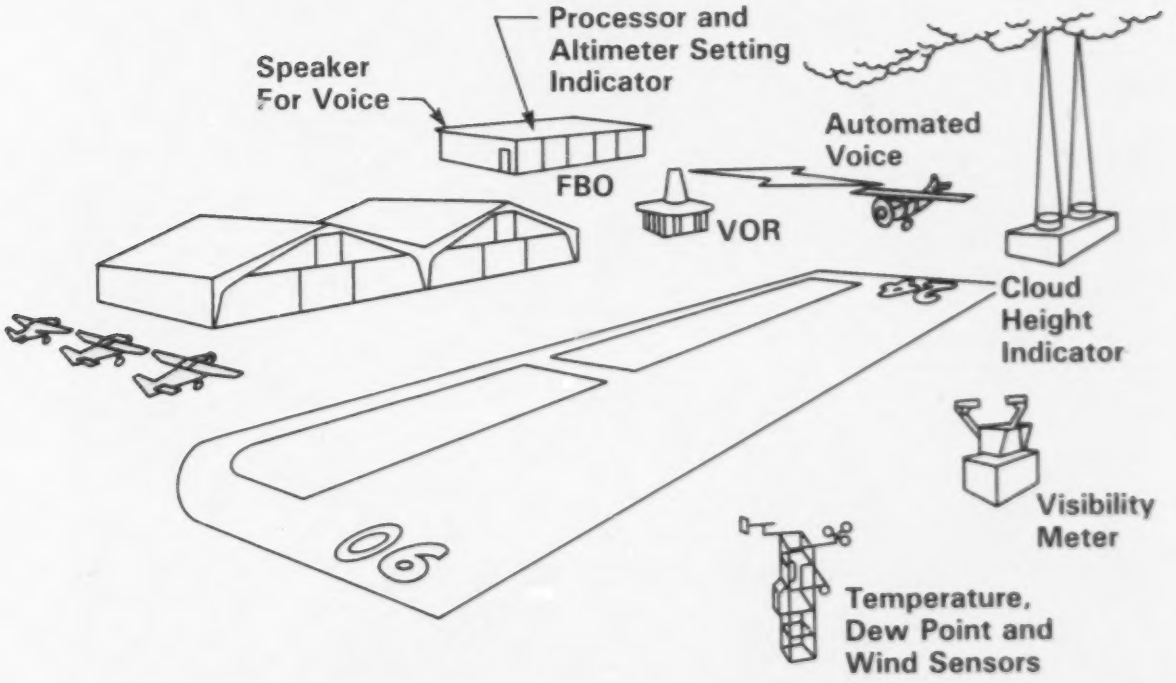


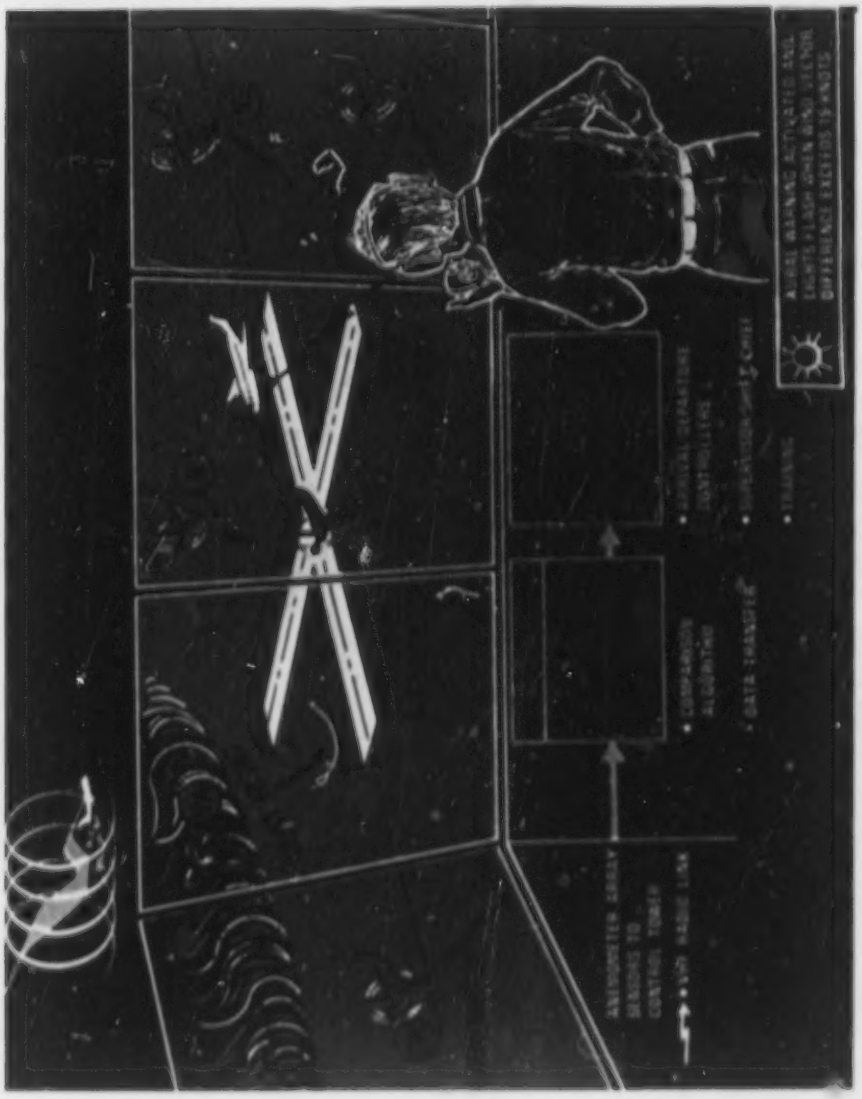






Automated
Weather Observation System





What is NEXRAD?

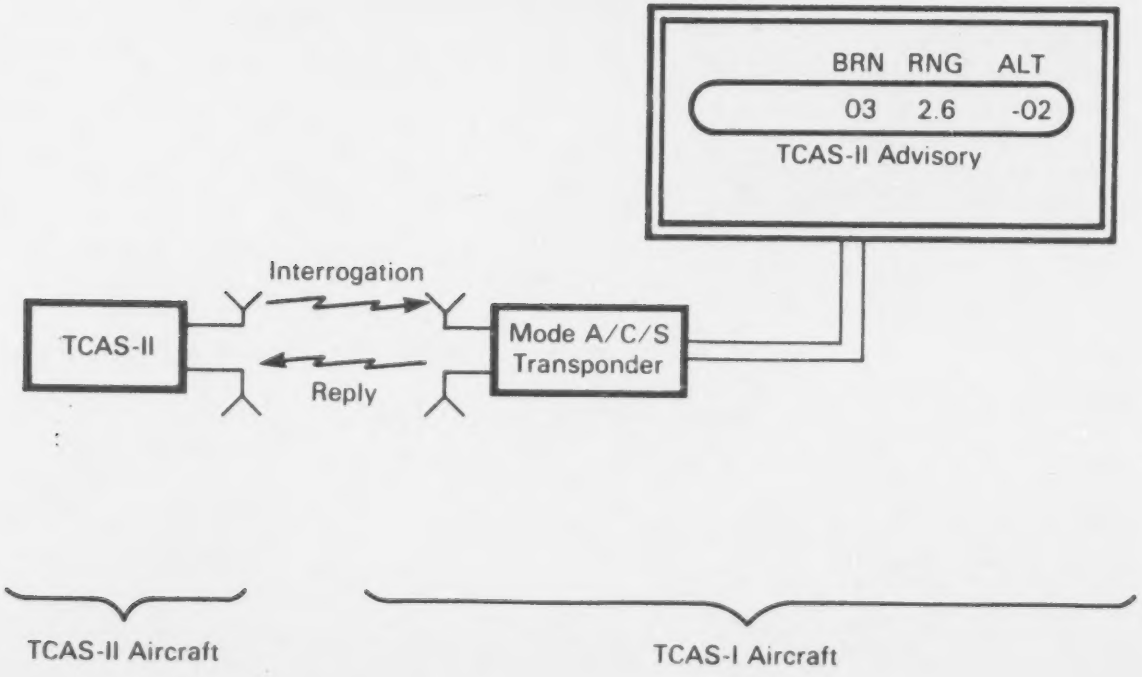
Pulse Doppler Radar

Processors

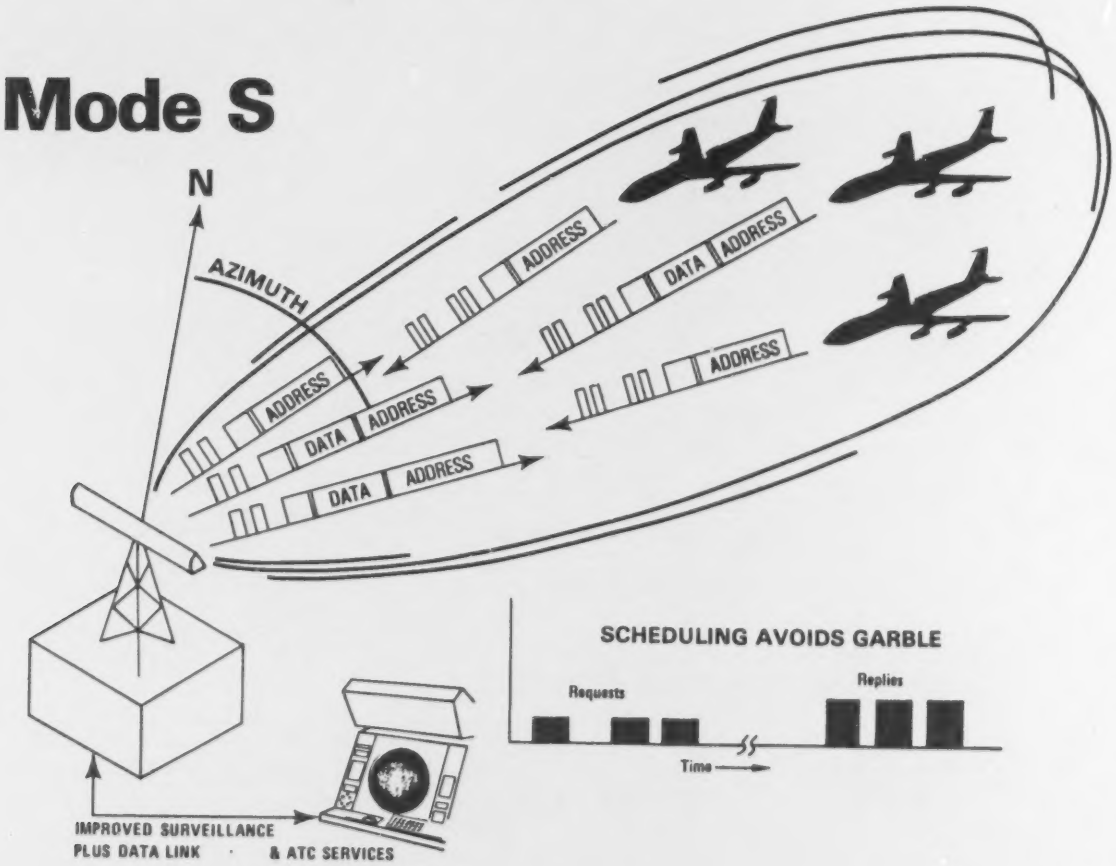
Displays

Data Communications

Means of Displaying TCAS-II Advisories



Mode S


N
AZIMUTH
ADDRESS
DATA
ADDRESS
DATA
ADDRESS
ADDRESS
DATA
ADDRESS
ADDRESS
SCHEDULING AVOIDS GARBLE
Requests
Replies
Time
IMPROVED SURVEILLANCE
PLUS DATA LINK
& ATC SERVICES

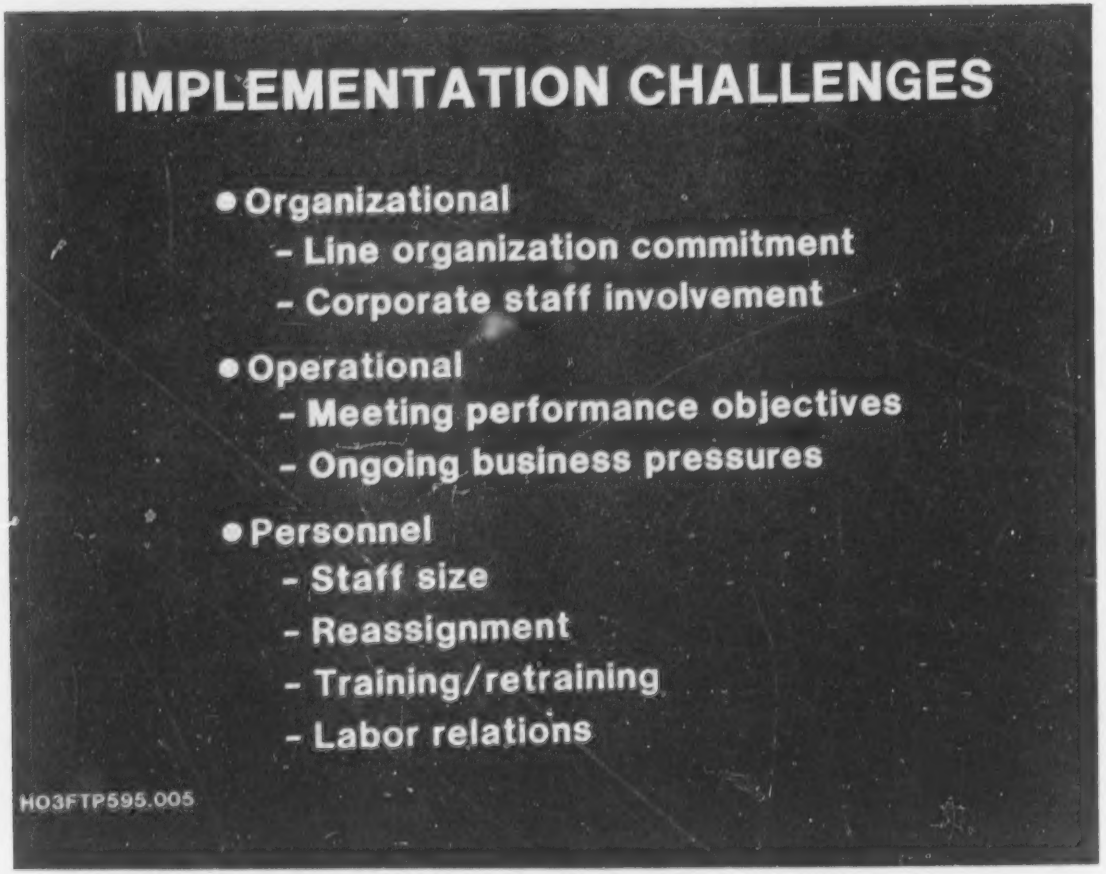
Mode S

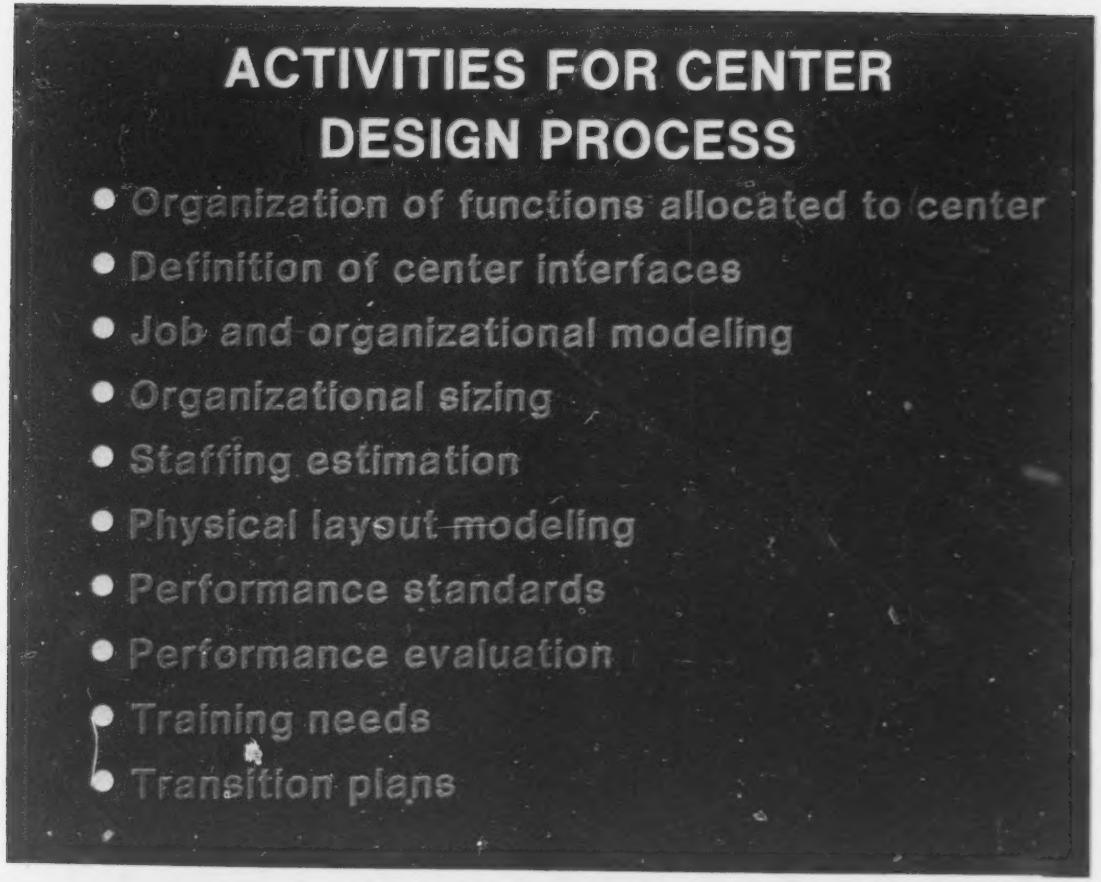
Surveillance:

- Basic Upgrade of ATCRBS
- Virtually Eliminates Most Beacon Difficulties (Synchronous Garble, Target Splits, etc.) & Reduces False Targets
- Improves Azimuth Accuracy
- Increases Traffic Capacity

Communications:

- Provides Two-Way Data Link
- Supports Automation (Metering & Spacing, Closer Aircraft Spacing, Airport Surveillance)
- Provides Voice Backup/Confirmation
- Provides TCAS Coordination Link


IMPLEMENTATION CHALLENGES
• Organizational
- Line organization commitment
- Corporate staff involvement
• Operational
- Meeting performance objectives
- Ongoing business pressures
• Personnel
- Staff size
- Reassignment
- Training/retraining
- Labor relations
HO3FTP595.005


ACTIVITIES FOR CENTER DESIGN PROCESS
Organization of functions allocated to center
Definition of center interfaces
Job and organizational modeling
Organizational sizing
Staffing estimation
Physical layout modeling
Performance standards
Performance evaluation
Training needs
Transition plans

System - Today

- Labor intensive
- Old technology - mix
- Frequent site visits
- On-site repair and certification
- Dispersed workforce
- Stand-alone systems
- Manual documentation
- Static system analysis
- Skills -
    - Vertical knowledge
    - Circuit tracing and repair
    - Hardware orientation

System — Year 2000

- RMM (. Real time analysis
  (. Dynamic
- Remote certification
- State of art equipment
- Interface control (systems)
- Integrated and interdependent systems
- Networked configurations
- Consolidation of work centers
- High reliability (. Failure prediction
  (. Trend analysis
- Functional redundancy
- Echelon maintenance
- Automated documentation
- Skills —
  - Horizontal knowledge
  - Diagnostician
  - System analyst
  - Engineering
- Less manpower intensive

OPERATIONS PLANNING METHODOLOGY

- Define tasks
- Identify functions
- Sequence functions
- Allocate functions to people or systems
- Allocate functions among new/existing work groups and systems
- Formulate operations process
- Implement
  - Specific requirements and development
  - Deployment
  - Feedback

OPERATIONS SYSTEMS

TRENDS
100
75
50
25
0
MILLIONS OF SUBSCRIBER LINES
TOTAL
STORED PROGRAM CONTROL (ELECTRONIC)
ELECTROMECHANICAL
'75
'80
'85
'90
YEAR

Quality of Service

QS = QA + QC

Where?

Quality assurance (QA) is a planned and systematic pattern of all actions which are necessary to provide adequate confidence that an item or product conforms to established technical requirements.

- **Internal evaluation**
- **Technical inspection**
- **Standards**
- **System level certification**

Quality control (QC) comprises those operational techniques and activities which sustain a quality of product or service that will satisfy given needs. Also the use of such techniques and activities.

- **Periodic maintenance**
- **Equipment level certification**
- **Software testing**

User Concerns

Users

- Air traffic
- Aviation standards
- Department of Defense
- Other Governmental/ICAO
  - Congress
  - Customs
  - USFS/DEA/NWS
- General aviation
- Air carrier
- Airports/state DOT, etc.

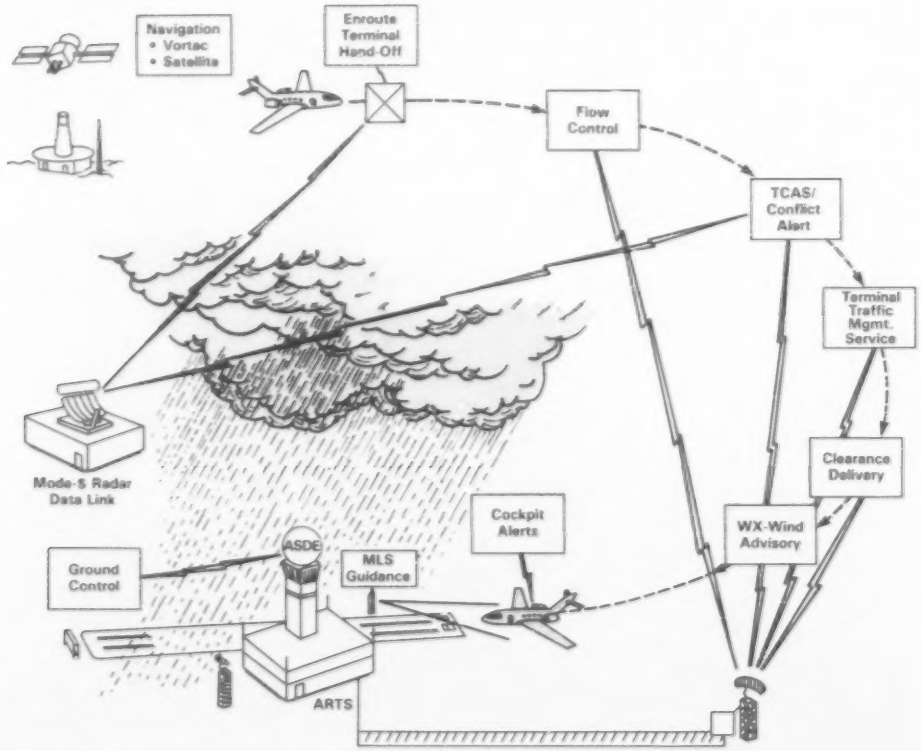
Concerns

- Safety
- Confidence
- Availability
- Integrity
- Interface/coordination
- Effects of job action
- Capacity
- Transition
- Cost/user fees
- Security
- Nonavailability of technical expertise

Human Concerns

- Potential loss of jobs
- Employee relocation and retraining
- Career progression

Terminal System



SRDS
ILS LIMITATIONS
NOT PRACTICAL AT ALL LANDING SITES
LIMITED CHANNELS
NEW REQUIREMENTS
VARIOUS APPROACH PATHS
GREATER ACCURACY
COMPLEX ENVIRONMENTS
TRANSPORTABLE
SHIPBOARD INSTALLATION